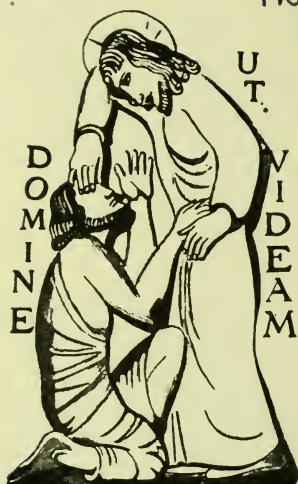


THE CONJUNCTIVA
IN
HEALTH AND DISEASE

N. BISHOP HARMAN

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THE CONJUNCTIVA IN HEALTH AND
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THE CONJUNCTIVA

IN

HEALTH AND DISEASE

Being a Record of some Research Work

BY

N. BISHOP HARMAN

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LONDON
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8, HENRIETTA STREET, COVENT GARDEN

1905

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To the Reader.

Who faulteth not, liueth not; who mendeth faults
is commended: The Printer hath faulted a little:
it may be the author ouersighted more. Thy
paine (Reader) is the least; then erre not thou
most by misconstruing or sharpe censuring; least
thou be more vncharitable, then either of them
hath been heedlesse: God amend and guide vs all.

Robartes on Tythes, Camb. 1613.

P R E F A C E

‘ Now Leah was tender eyed.’ Such is the rendering by Tudor translators of a passage in the Pentateuch some four thousand years old. It has the tone of apology. Leah was a woman who suffered, and was remarked among a race of bright-eyed people.

There is no doubt that conjunctivitis is a very ancient and widespread affection.

In these pages I have endeavoured to set forth three sets of observations on the condition of the conjunctiva in health and in various forms of inflammation, including complete bacteriological examinations in 400 subjects. The observations refer in the main to work done in London and its near neighbourhood.

The state of the conjunctiva will be treated of—

1. In health, as determined by a systematic examination of children in elementary schools in one great district of London; in laboratory work, both as regards the anatomy of the region and in bacteriological examinations of the fornices and lid margins.

2. In disease, as found both clinically and pathologically, with investigations into the treatment of the

disease. In pathological work I have endeavoured to bear in mind that the conjunctiva is just part of the body, for I think the present-day tendency to separate eye pathology from general pathology is not devoid of evil. During the progress of the work it has been my good fortune to have the duty of teaching a laboratory class in general morbid anatomy, and herein I have seen things which to my mind throw light on the mysteries of such diseases as trachoma and spring catarrh.

The clinical characters of the inflammations of the conjunctiva have been so often and so ably treated by masters of the subject that it is hardly possible to add to their luminous descriptions. Yet I have endeavoured to set out conditions as I have found them, and to discuss in this connection the observations and views of others. In particular, I have sought to recover part of the great store of clinical wealth hidden in our libraries in the writings of those old masters whose work is the foundation of our present knowledge.

3. In a sociological inquiry, wherein the incidence of disease, as affected by age, by the season of the year, and by the social status of the subject, will be examined. This was laborious work, but the results are so interesting and striking that the trouble is recompensed.

A classified list of the more important works on the subject will be found printed separately in Chapter XXI., at the end of the book. I think the relegation of this matter to one place will relieve the reader, save time and labour when a reference is required, and provide at the same time an index of authors.

My thanks are due to many who have in most generous fashion aided me in the course of this work, and without whose assistance the doing of it would have been impossible—more especially to Mr. W. Lang and Mr. T. W. Holmes Spicer for the unrestricted use of cases attending their clinics at the Middlesex and Moorfields Hospitals ; and to Mr. Alexander T. R. Foulerton, Director of the Laboratories of Clinical Pathology at the Middlesex Hospital, for the freedom of his laboratories and his kindness in performing inoculation experiments for me.

NATHANIEL BISHOP HARMAN.

QUEEN ANNE STREET,
LONDON, W.,

January, 1905.

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 ERRATUM.

Page 19, line 7 from bottom, for 'thirty-nine' read 'thirty.'

CHAPTER I

HISTORICAL

THE growth in the understanding of inflammation of the conjunctiva is marked by two outstanding epochs. The first occurred at the commencement of the nineteenth century, in a period when alarming epidemics of a most virulent ophthalmia, styled 'Egyptian,' spread over Europe, coincident with the return to their homes of large bodies of troops who had suffered seriously from the disease during the campaign in Egypt.

The second epoch arose about the commencement of the last third of the same century, out of the researches of Pasteur and Lister into the etiology of fermentation and inflammatory processes, and the direct connection of these with the life-history of living organisms.

The fruits of this last epoch have been rich beyond comparison with those obtained in the earlier. But when we consider the darkness of the scientific intelligence as shown by the dicta of the exponents of ophthalmic medicine prior to the epidemic of Egyptian ophthalmia, the conclusions arrived at by some of the surgeons engaged in observing and combating that epidemic are brilliant in the extreme. When we remember that in these medieval times of medicine it was the accepted view that an inflammatory process in any part arose out of

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some general bodily disturbance, which caused the determination of a vicious blood to the affected part, and especially repudiated the idea that the inflammation might be due to local processes, we are the more impressed with their advances.

The work done during these epidemics was rich in good results, and in no country more so than in England. The work of JOHN VETCH, a British army surgeon, is alone sufficient to mark the period. His little monograph of 140 pages, of the year 1807, is precise in observations recorded and clear in its conclusion as any modern work produced under incomparably more favourable circumstances. Interpolate the word 'micro-organism' in a few of his sentences, and the case he sets forth is complete. Indeed, in some respects he was not only in advance of his own time, but right amongst us in his deductions. For he came to the conclusion that the same cause could produce in the same man, at different times, a urethritis, a purulent ophthalmia, an arthritis, and an iritis—a bold conclusion, for which Mackenzie, in his most excellent text-book of twenty-three years later, takes Vetch to task.

I have read many of the books of this period and of earlier date ; there can be no comparison between works such as those of Kennedy, Read, and Rowley, and those of Vetch, Wardrop, Mackenzie, and Saunders.* The wideness of the gulf separating them cannot be more vividly shown than by the perusal of these short abstracts from works written within only seventeen years of each other.

William Rowley, M.D., M.R.C.P. : 'A Treatise on One Hundred and Eighteen Principal Diseases of the Eyes

* The founder of the Royal London Ophthalmic Hospital, Moorfields.

and Eyelids, etc.,’ London, 1790. Page 145 (the italics are the author’s) :

‘ One very extraordinary instance may be mentioned. A child was brought to the Foundling Hospital born blind—in short, no eyes were to be seen, but in their place two protuberating pieces of flesh, which had an appearance of raw meat. The medical gent who presided over the hospital declined attempting anything, but wittily observed that remedies might as well be applied to the cuff of his coat as to the blind infant, and spurned with contempt every idea of relief. . . .’

‘ The case was very extraordinary ; but I undertook to try the force of medicines given to the nurse. . . .’

‘ The infant seemed in continual pain, and all I proposed was, to lessen or remove the inflammation, and to mitigate the pains.’

‘ I gave the woman a pill of twelve times sublimed calomel, well washed, and sulphur auratum antimonii. These ingredients were triturated together for twelve hours, by which the powder becomes perfectly alterative, and never acts either as purgative or salivant.’

‘ From 1 to 2 grains was the dose given, three or four times a day ; after each dose was given $\frac{1}{2}$ drachm of nitre dissolved.’

‘ The woman was directed to avoid all greens, fruit, and acids, as vinegar, etc. . . .’

‘ In the course of six weeks, by these modes of treatment of the mother, without any *external* application to the *eyes* of the infant, the red flesh, which proved to be an enlargement and extraversion of the lids, was so reduced in size that the globe of the eyes could be seen ; but the cornea of both were opaque, not admitting the least ray of light. This was repeatedly confirmed by trials with lighted candles and other conclusive modes.’

‘ All that was first intended was performed. . . . The infant became perfectly tranquil, and the eyelids were nearly of a proper appearance in about the third month.’

He then declined further attendance, but continued, under ‘ the earnest solicitude of the mother.’

He dosed the mother more vigorously with tartar emetic and corrosive sublimate. . . .

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‘In about three months after the infant began to have some glimmering of light, and the cornea of one eye appeared partially transparent. . . .’

He therefore continued treating the mother.

‘After eight months . . . the baby was taken from the mother to be baptized. . . . One of the governors of the charity . . . directed its name to be William Rowley, as a compliment for my attendance and success. . . .’

‘This is, amongst many, the strongest instance I have ever seen of the efficacy of administering remedies to the nurse for diseases of infants ; but such facts well merit the attention of every humane practitioner in physic and surgery.’

John Vetch, M.D., M.Med.Soc.Ed., Assistant Surgeon to the 54th Foot : ‘An Account of the Ophthalmia which has appeared in England since the Return of the British Army from Egypt.’ London, 1807.

Page 123, On contagion :

‘No military or medical officer has yet contracted the disease without being sensible of some local communication, and the uniform escape of those of both capacities who daily inspect the sick is a sufficient answer . . . to the explanation that it propagates by some subtile effluvia arising either from the system or the eye of the patient.’

‘I have examined with impunity the eyes when under any particular state of the disease with a glass whose focus requires that the eye of the observer must be within less than 1 inch of the object. The opinion that the disease is communicated in the manner I have endeavoured to maintain now prevails so generally among . . . officers of those regiments in which it has occurred in England that all fear of receiving the disease in any other way is completely laid aside.’

Page 127, On prevention :

‘I have observed in many cases the disease has advanced to such a state as to form purulent matter before the patient was himself aware that he was affected. A minute and daily inspection by the medical officers becomes a duty of the first moment, both on account of

the individuals who may be affected, and their comrades, by the immediate removal of the former. To prevent, however, the consequences which may accrue before the discovery of the disease, other means should not be neglected ; every precaution should be instilled into the men to induce them, of their own accord, to be attentive in avoiding the disease.'

'The use of barrack towels should be laid aside on the first appearance of the disease, as they afford a constant medium for its communication ; at the same time, if the men are not provided with separate towels, they will, in all probability, have recourse to some other article, which they will use in common, while it will be less frequently renewed.'

'Separating the men as much as possible is a good precaution, though by placing them in cantonments we must effect any good at the expense of the inhabitants.'

'To prevent the contagious matter from taking effect, should it have got access to the eyes, in defiance of these precautions, it will be found a very salutary practice frequently to parade the men with separate vessels of water, while an officer attends to see their faces and eyes carefully washed.'

'As exposure to sun, exercise, or similar causes, cannot produce the disease unless its specific contagion has been previously applied, no danger need be apprehended from making the healthy undergo their usual fatigue, which may even have the good effect of making any cases which are latent more liable to detection by the aggravation it may occasion.'

In his remarks on treatment it is clear that Vetch had a growing doubt as to the benefit of the liberal bleedings, drenchings, and blisterings so fashionable, and favoured the direct local application of litharge, muriate of mercury, alum lotions, and, above all, lunar caustic, to the seat of the inflammation.

No greater wrench from the vicious oppression of the pathology of the day can be conceived.

All honour to the men who with much labour and pain first showed the way to the more certain conclusions of our times !

CHAPTER II

THE GENERAL ANATOMY OF THE CONJUNCTIVA

IN considering the anatomy of the conjunctiva, facts of chief importance to be always kept in mind are : that the conjunctiva is in its origin of the same nature as the skin, the common covering of the body ; and that it has potentially all the appendages proper to the skin ; but that these characters and appendages are profoundly modified in their distribution and development, by a most beautiful adaptation to the service of the visual organ.

The ordinary integument consists of true and scarf skins, glands, and a protecting coat of hair, downy or well grown. The relation of the true skin to the subjacent parts varies : in parts it overrides it easily, then the connection is of the loosest, as on the back of the hand ; in others it is firmly bound down to them, as on the palms of the hands. The character of the scarf skin varies directly with these conditions : when the true skin is loosely adherent to the underlying structures, the scarf skin is soft, smooth, and thin ; when it is firmly bound down, the scarf skin exhibits a marked papillary character.

So also with the conjunctiva. There is the cutis vera of delicate woven connective tissue, in which elastic fibres predominate ; it carries bloodvessels, nerves, and

lymphatics. In parts it is loose, almost unattached, as in the retrotarsal folds and in the portion applied to the globe; here the cuticular layer is a thin, smooth layer of cells, some half-dozen deep, short columnar at the base, tending to be squamous at the surface. The membrane in these regions is easily thrown into folds; it is so elastic that in inflammation it may be swollen to a great size.

On the other hand, over the surfaces of the lids the membrane is, to a large degree, adherent: in direct proportion to the firmness of texture of the underlying tissues of the lid, there is an adhesion of the membrane to the lids and an alteration in the character of the epithelial covering. Over the lower lid the fixation of the membrane is moderately firm, over the upper lid and cornea it is complete. The membrane of the lower lid shows few papillæ, and these not true ones, for they do not contain vascular loops (Steida, Wolfring), and the cellular covering is delicate. Over the upper lid the papillary character is marked by the presence of fine ridges, of such a kind that the recesses between them were at one time considered to be glands (Henle); the cellular covering is proportionately thickened. Over the cornea the blending, in man, of the cutis and underlying meso-blast has proceeded to such a degree that they form one structure, the *substantia propria* of the cornea. This union of the corneal constituents is not so complete in all vertebrates; in many fish the two are easily separable, and are frequently sundered in disease (Lightbody, Harman).

The glands of the conjunctiva have undergone a marked adaptation. The sweat glands have become aggregated as the lachrymal gland, a compact mass discharging their secretion by some dozen ducts in one region of the upper fornix; the compaction of its parts is not always complete;

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it is not infrequent to find associated glands of large size as congenital anomalies, and they are almost constantly present in microscopic form (Krause). The united glands have lost the utility of a sweat gland in the heat regulating mechanism of the body, but their susceptibility to emotional impulses has been enormously increased. The sebaceous glands, now known as Meibomian, are ranged in rank along the margins of the lids, so that their secretion is poured out at the edge of the lids, where alone it would be of use, for here only is there friction.

The cells of the scarf skin of the general integument have an intrinsic glandular action of the primitive order, an order in which every epithelial cell stores up within its structure substances which are later discharged, and, curiously enough, the completion of this metabolism constitutes what is practically the death of the cell. In the early vertebrates—*e.g.*, fish and reptiles—this individual secretion is mucus; the cells swell up with mucin, burst, discharge their contents on the surface, and shrivel. In man the conjunctiva alone, of all the body surface, retains this primitive glandular secretion of mucin; it provides a smooth, frictionless surface to the movements of the globe.

The movement of the sebaceous glands to the edges of the lids has been coincident with a similar change in the hair distribution; none is now found on the conjunctiva, except at one point. Within the inner canthus are the plica semilunaris and caruncle. The plica is the third eyelid. Of large size in some fish and in birds, of fair size in many mammals, it has shrunk to this small fold in man; probably, since his forelimbs are employed in the service of the head, there is less necessity for a third lid. The caruncle is the humped-up outer part of this third lid. In fish and birds when these

lids are well grown there is no caruncles ; in the cat and dog there is no caruncle, but a considerable quantity of connective, fatty, and glandular tissue in the substance of the reduced third lid ; in the horse and ox the fold is smaller, and there is a fair-sized caruncle ; in man the fold is minute, and the caruncle well grown, and with adult age a few downy hairs may be seen growing from its summit, an appearance quite in agreement with the morphology of the part, for in the shark a coat of denticles or shagreen is found to grow on those parts of the third lid which are continuously exposed, even as upon the general surface of the body.

The arterial supply of the conjunctiva is very rich. An anterior group of vessels springs from the anterior ciliary arteries to supply the front part of the ocular conjunctiva. A posterior group, derived from the vessels of the lids and lachrymal gland, supply the reflected and tarsal conjunctiva. The vessels of the lids are disposed in arches about the margins between the skin and tarsal plates. The arches are connected with arteries at all points by the angular (facial), infra-orbital, temporal, supra-orbital, palpebral, frontal, and nasal branches of the ophthalmic artery. The anastomosis is most free in all directions ; the anterior and posterior conjunctivals unite with each other, and by derivation these are connected with the lid vessels superiorly, and with the ciliary vessels deeply.

The veins principally debouch into angular and temporal effluents ; there are lesser connections with the orbital vein, and so to the cavernous sinus.

As regards the finer arterial distribution, the region of the limbus demands note. It has a most complete network of delicate arteries, providing a perfect anastomosis. The vessels running to it divide and unite with each

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other to form arches ; from these many succeeding arches of diminishing size arise, forming a delicate tracery. From this vascular ring, in the foetus, looped vessels pass into the superficial layers of the periphery of the cornea (Stellwag); and therefrom, under the stimulation of any continuous irritation, similar vessels again penetrate the cornea.

The lymphatics are numerous. They pass by the outer canthus to the præ-auricular gland ; they radiate from the cornea, whence they spring in the marginal region of the outer layers (Teichmann, Henle, Englemann, Müller). Their passage by the outer canthus is not infrequently demonstrated in styes of this region ; the local inflammation causes blocking of the lymphatics and local œdema of the conjunctiva of considerable intensity.

The nerve-supply is also most complete, particularly in the regions of the lids and in the limbus ; the reflections are less sensitive. For the most part the endings are terminal, non-medullated, and tortuous twigs (Helfreich), but special end bulbs have been described (Kölliker, Krause). The source of the nerves supplying the conjunctiva need not be considered in detail here, since the subject must be dealt with in connection with phlyctenular conjunctivitis. Suffice it to note that it is from the trigeminal, and the first and second divisions of that nerve.

There has to be considered the important adenoid provision in the membrane. This also is deferred for a later section—The Follicles of the Conjunctiva.

I make no particular reference to the few sebaceous glands and the diminutive sweat glands (Mohl) found close within the line of the cilia. Their presence does not greatly influence matters.

The Tolerance of the Conjunctiva.—The exposure of

The General Anatomy of the Conjunctiva 11

so delicate a membrane to the wind and dust, and particularly to the atmosphere of our great cities, which teems with micro-organisms, blown about in fragments of dried excreta from beasts of burden, or in other refuse, would lead one to expect that conjunctivitis should be a most prevalent complaint.

He who comes fresh from the country on an August day into the centre of London does not fail to remark the smell of dung which is everywhere. Usually he will complain of a slight nasal and pharyngeal catarrh at the close of the day. I have frequently crossed London on a cycle from north to south, or from east to west, on a hot, dusty day; during the passage the eyes had to be frequently wiped to free them from dust, yet in the evening a dryness of the throat was a much more common complaint than any irritation of the eyes.

This toleration must be credited to the beauty of the protecting arrangements of the eye: the smallness of the exposed part when wind is strong or dust excessive; the continuous discharge of mucus from the goblet cells of the mucosa; and the sweep of the lids as they close from without inwards in the rapid action of blinking, driving all débris and secretion towards the lacus.

If the protection of the eye be good in man, it is in most mammals even more elaborate. Many animals are possessed of a retractor bulbi musculature, so that they have the power not only of covering the eye with the lids when danger threatens, but of actually withdrawing it into the socket. This exquisite arrangement can be well seen in a cat: when it is awake its eyes are prominent between the lid margins, more so than in many men; when the cat closes its eyes, the lids meet as over an even surface without any prominence, whilst in man the closure of the lids still leaves marked the shape of the

eyeball. I think that this provision in animals may account for the comparative infrequency with which conjunctivitis is seen amongst them.

I was immensely struck with the toleration of the conjunctiva when I saw troops on the march in dusty South Africa. On one occasion I had to examine a large number of men who had just completed a long and tedious march, the last part of which lay through a big and dirty town. The colour of the men was dusty—the natural tinting of powdered earth; faces were grimed with sweat and dirt, eyebrows and lashes clogged with dust; and as they stood to attention for the inspection, the dust floated as a film on the fluid lying in the lacus and along the rim of the lower lid! There was no excessive blinking; apparently the mucous membranes of the men had become accustomed to the conditions. These particular men, by the way, were Australian Bushmen; they had come from a region where ‘sand-blight’ is said to occur. I saw no evidence of such affection among them, though for the special purposes of this parade I examined the conjunctivæ of every man of them.

South Africa is second to no country in dustiness and brilliancy of sunshine, yet my experience was that conjunctivitis is no more frequent there than in England. During my period of service in the Army Medical Department (1900-1901) I had charge of British and Colonial troops. I remember well a severe case of gonorrhœal conjunctivitis, but ordinary catarrhs were rarities; and of trachoma I saw no sign. I examined many negroes on stations and in their own villages of ramshackle dwellings on the veld, and, save for a couple of ‘white kaffirs,’ (albino) children, who had blepharitis, I saw no eye disease. I had charge for a long time, and was in close contact with many hundreds of Boer prisoners; there was

The General Anatomy of the Conjunctiva

no evidence of any prevalence of conjunctivitis, past or present, though the frequency of pinguiculæ and pterygia in both young adults and veterans was eloquent testimony to the wind and dust of the country.



FIG. 1.—THE TOLERANCE OF THE CONJUNCTIVA. FEMALE AET. 36.
CHRONIC LUPUS.

There is not a vestige of skin over the whole face and part of neck. The right eye ulcerated, and was removed five years ago ; its site is hidden by scar tissue. The left lids are gone, so the eye is always exposed ; the cornea is opaque, but the conjunctiva remains moist and supple ; the intrinsic mucous secretion is rather increased, and tears flow.

My experience, therefore, leads me to distrust the influence of wind and dust as determining factors in any

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particular form of conjunctivitis, trachoma especially. They are undoubtedly adjuvant factors, and in so far as foreign bodies bring in pathogenic organisms, or cause abrasions of surfaces, they become primary agents ; but the assignment of specific varieties of inflammations to these agencies—wind and dust—is, I think, incorrect.

Recently I saw in a Poor-Law infirmary two extreme cases of exposure of the conjunctiva which well illustrated the tolerance of the membrane. The one, a woman of thirty-six years, was the victim of lupus (Fig. 1). There was not a vestige of skin over the whole face and forehead and part of the neck : all was scar tissue. The nose was lost, the mouth reduced to a small hole ; the right eye had ulcerated and been removed five years ago ; its site was completely lost in the smooth scar tissue of the face. The left eye had lost its lids completely, and was exposed like the eye of a plaice ; the cornea was opaque, yet the conjunctiva remained moist and supple ; the intrinsic mucous secretion was rather increased.

The other, a woman of fifty-two years, had suffered from extreme ectropion of the lower lids, due to syphilitic scarring of the whole of the face and most of the forehead. The nose was reduced to a small hole, the mouth grotesquely twisted. The upper eyelids were fixed to the brow by bands of scar tissue, and the lower lids completely smoothed out over the malar bone. Despite this extreme exposure, there was no xerosis, the membrane was moist, and examination of the flora of its surface discovered cocci alone.

CHAPTER III

SOCIOLOGICAL INQUIRY

IN this section I shall endeavour to set out the incidence of inflammatory conditions of the mucous membrane of the eye, both as regards the age, sex, and social condition of the subject, and in relation to the season of the year.

The material for this inquiry has been obtained from four sources :

1. The ophthalmic department of the Belgrave Hospital for Children.
2. One of the clinics of the Moorfields Eye Hospital.
3. The children attending the public elementary schools of one of the sections of London.
4. The blind schools of the London County Council.

Each of these sources, from the special conditions associated with it, presents interesting features.

1. The Belgrave Hospital, whence one set of material was obtained, was, before its removal to its present palatial abode, a small general hospital situated in South-West London, in one of those lost or deserted districts where an estate built according to the plan of a great landowner had failed its object. The district was healthy, open, and accessible; the streets wide and well laid; the houses, though gloomy in appearance,

clothed in a mock semblance of stone and decked with frowning porticos and massy pillars of equally sham substance, roomy, well lighted, with ample garden spaces. By the set of fashion, it has been shut in on one side by the houses of the rich, on the other sides the growth of great railways has separated it, so that this area stands almost isolated. No one would pass through it unless he had business therein. It comes to pass, then, that the eye clinic of the hospital was small and the patients purely local; there was no alien admixture. The incidence of cases may be taken as representative of English poor generally. I have examined the letters of these patients for ten years—1892 to 1901.* In each case the disease, season, age, treatment, and duration of treatment has been noted on tabular sheets. The results are shown as concisely as possible.

2. The clinic at Moorfields is one of twelve bi-weekly clinics. It is held on Wednesdays and Saturdays, and is under the care of Mr. T. W. Holmes Spicer, to whom my thanks are due for his permission to utilize his case-papers. The personnel of the patients attending on Wednesdays is fairly representative of the population of the east of London; the few provincials coming to the hospital for special advice do not materially affect it, for they are relatively few. On Saturdays the conditions are very different: large numbers of alien Jews attend; whereas on Wednesdays the proportion of alien to native is less than 1 in 30, on Saturdays it rises as high as 1 in 3. Large numbers of these Hebrews are strangers who have recently arrived in the country in

* The majority of these patients were under the care of my predecessor, Mr. Treacher Collins, and to the care with which points of diagnosis and condition were noted is due the interest of the results ascertained.

a pitiable state of wretchedness, dirt, and too often disease. The influence of these patients on the incidence of inflammatory disease has been remarkable, and for the purpose of this inquiry useful, for it affords the opportunity of comparing the incidence of disease in relation to social status. These aliens are very poor; they have come from regions where they have been crowded into dirty and insufficient quarters. Their sojourn in this country, for the greater number of them, has not materially affected the results arising out of this overcrowding; indeed, with very many the conditions of life have not been altered.

Now, although many of the patients of the indigenous population are very poor, dirty, and overcrowded, yet, taken in the main, there can be no doubt that the patients of the indigenous population enjoy healthier, happier conditions than the alien immigrants. By separating the cases of these two classes of patients it is possible to compare the incidence of disease in the two classes.*

The letters of the Moorfields clinic were examined for one year—1902. There were nearly 3,000 cases. The primary tables obtained by the examination of these case-papers are altogether too unwieldy to publish. The

* It is perhaps well I should add here an explanatory note. The contrasting of native and alien people has been of recent date a subject of bitter controversy in Europe: the alien, on varying grounds, has been almost without exception contemned. The comparison I shall here make of the incidence of disease in our native and in our alien patients is not between native and alien as such, but between those who in bulk are fairly circumstanced and those who are much overcrowded. And I shall show that if any advantage lies with the native on account of his being fairly well situated, the advantage is at once lost in conditions of overcrowding and poverty similar to that common to the alien. With the cause of alien immigration and overcrowding this work has nothing to do.

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features of interest have been extracted, and are shown in as graphic a manner as possible, so that they may tell their tale with as little explanatory text as may be.

3. The third set of data comes from the examination of the public elementary schools of the London County Council (late School Board for London) in the great district of London known as Hackney. It extends from South Tottenham on the north to Bethnal Green on the south, from City Road on the west to the Lea River and the Hackney marshes on the east. It is a huge and populous area. In the northern parts the class of inhabitants and the nature of their surroundings are very different to the folk and conditions of the folk in the crowded southern region. This difference has enabled me to make a series of interesting observations on the incidence of eye conditions under varying conditions of life.

In six months of the year 1903 I examined individually 22,000 children in thirty schools (infants are excluded from this count). In some schools I made particular notes on certain conditions, and in others comparative bacteriological tests.

4. In the years 1903 and 1904 I examined the children receiving instruction in the schools and centres for blind children under the London County Council. By the Elementary Education Act that authority is responsible for the education of all blind children until the age of sixteen years, unless they are otherwise trained. There are nine of these schools and centres scattered over London. In them I saw 255 children ; in each case a detailed note was made as to the nature and probable cause of the disability.

The Treatment of the Material.

In dealing with the material of the Moorfields clinic it was, as may be supposed, by no means easy to arrange 3,000 cases of eye disease in such a manner as would show what, if any, lessons the incidence of the many forms of disease had to teach us. A satisfactory plan was obtained by the adoption of two procedures :

I. A system of age-grouping.

II. The reference of the incidence of disease to a constant.

I. **Age-grouping.**—The ages of patients ranged from a few days to eighty and more years. To tabulate an age incidence for so many years would have been very difficult, and the results of no great value from their diffuseness. I therefore grouped the cases according to the conditions of life of the patients as suggested by their age :

1. Infancy age-group, from birth to three years. There are the risks of birth and the period of nursing, until the babies crawl or toddle about at home, getting proportionately grubby as their home is ill-kept and dirty.

2. School age-group, from three to fourteen years. During these ages most of the children who form the class of hospital patients are in attendance at public elementary schools.

3. Young adult age-group, from fifteen to thirty-nine years. During these years folk move about a good deal, in search of convenient work, or seeking change. This group is subject to risks arising from these unsettled conditions.

4. Adult age-group, from thirty-one to fifty-five years. In this period folk are more or less stationary, with

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settled work and homes. The risks of this age-group are less than the former.

5. Elders age-group, including all ages exceeding fifty-six years (the number of years in this group have been calculated as twenty-five).

I think the selection of this method of 'age-grouping' will be justified by the lessons set out in the succeeding diagrams.

SUMMARY OF CASES IN THE MOORFIELDS CLINIC, 1902.

	Cases.	Percentage.
CONJUNCTIVITIS: Simple, mucopurulent, follicular, etc... ..	500	18·1
Purulent conjunctivitis	28	1·0
Angularconjunctivitis	44	1·6
TRACHOMA: Acute, 14; chronic, 19	33	1·2
Blepharitis	111	4·0
Phlyctenulæ	56	2·0
Superficial keratitis	135	4·9
Injuries	168	6·8
Refractions	1,442	52·3
Other diseases	220	7·9
Total	2,757	100·0

II. Choice of a 'Constant.'—The age-grouping and the marked inequality of the incidence of refraction cases require that the data be adjusted to some 'constant.' It was not easy to find this constant. A reference to urban population, or to the total case incidence, failed because of the inequality of the incidence of refraction cases. There are but few in the infant group, and a great preponderance in the school age-group. The percentages of refraction cases to all cases in each group work out as: Infants, 12·4; school, 60; young adults,

52·4; adults, 51·9; elders, 29·4. If I had cast the refractions out bodily, I might have been held guilty of 'begging the question' in the findings brought out. I found, however, one column in my tables the figures of which proved reasonably constant for each age-group when the number of years in that group was considered; the column contained conditions grouped as 'Other diseases.' It is a heterogeneous mixture of cases that occurs throughout life, or in infancy, in youth, or in age alone—lenticular, uveal, and fundus cases, having no definite connection with conjunctival conditions; yet, despite the mixture in the quality of the cases, in the mass they make a fair balance of quantity for each year of life. The proportions work out for infancy, 2·5; school age, 2; young adults, 3; adults, 2·7; elders, 2·8.

The figures in the column marked 'Other diseases' have accordingly been taken as a 'constant'; they have been raised to the value of 100, and all the figures of the corresponding age-groups raised to an equality with this adjustment of the constant.

This method of adjustment I have put to a most severe test, and it has been shown to be correct.* For by this means I have ascertained the comparative conditions of the visual acuity in our alien and native patients at Moorfields. A detailed examination on the same question has been made by the London School Board in the alien and native children of its schools. The results obtained by these different methods agree.

The statistics obtained from the Children's Hospital for the ten years do not need any adjustment. The disturbance of refraction cases comes in, but the con-

* Details (p. 33), On social conditions.

trasts are so marked and the years so few that adjustment is unnecessary.

The Age Incidence of Cases at Moorfields compared with the London Population Curve.

Fig. 2 gives the actual incidence of all cases in the clinic at Moorfields (= one-twelfth of all the cases attending Moorfields during the year). It shows that more patients attend in the young adult age-group than in any other. It will be more instructive, however, to compare this total case incidence with the figures of the

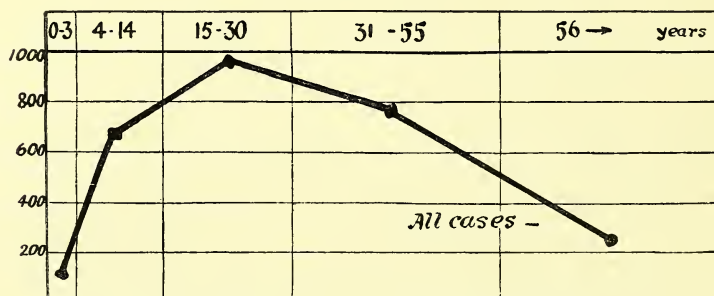


FIG. 2.—CASE INCIDENCE, MOORFIELDS CLINIC, 1902.

London population. (The number of persons living at the time of the 1901 census of each age-group was kindly supplied me by Mr. Howard Barnes, F.I.A., Secretary of the Pelican Life Office.) Fig. 3 shows the curve obtained by this comparison. There are seen to be but few cases in the infant group—only twenty-six cases per 100,000—but in the school age-group the incidence rises sharply to nearly sixty per 100,000; then there is maintained a very fair equality in subsequent years.

The reason for the sharp uprise from infancy to the school age will be shown as we dissect the main curve. Suppose we remove from it all cases of refraction, fundus

trouble, and the like, not connected with the superficies of the eye, there remains the curve of the incidence of superficial inflammations and injuries. If we still further dissect it and remove the cases of injury, there remains the curve of incidence of superficial inflammations only—a line which shows a steady and uninterrupted decline from infancy to age.

The count of the ten years of cases at the Belgrave Hospital for Children demonstrates this point very

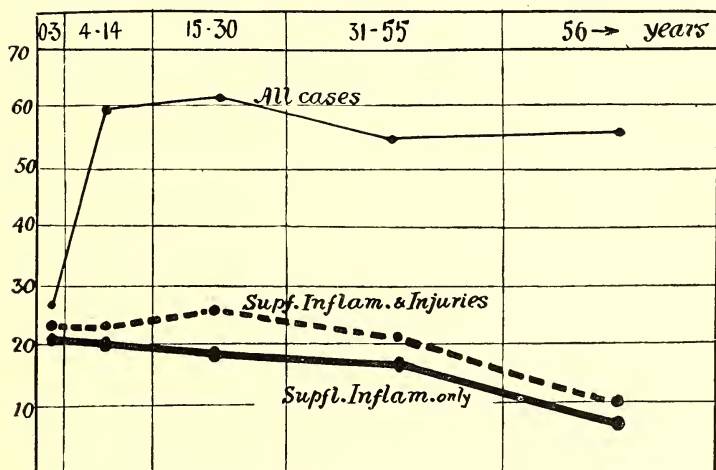


FIG. 3.—CASE INCIDENCE (MOORFIELDS CLINIC, 1902) PER 100,000 OF LONDON POPULATION.

well. Fig. 4 shows that between the ages of three and twelve years the refraction cases keep a fairly constant level, but surface inflammations are rapidly diminishing in frequency with each year of life. At first the cases of inflammation exceed those of refraction by nearly 3 to 1; at the last they fall below the refractions.

We conclude that the young of our kind are more susceptible to inflammatory disease of the surface coverings of the eye-ball than are the well grown. It is not

difficult to find a reason for this greater liability in youth. The risks of children are great, irrespective of those dangers peculiar to the time and accidents of birth. Children naturally grub about in the dirt, finger their faces, and convey the dirt to mouth, nose, and eyes ; in later years, with the cultivation of 'manners' and habits of self-control, liability to infection by such means is reduced.

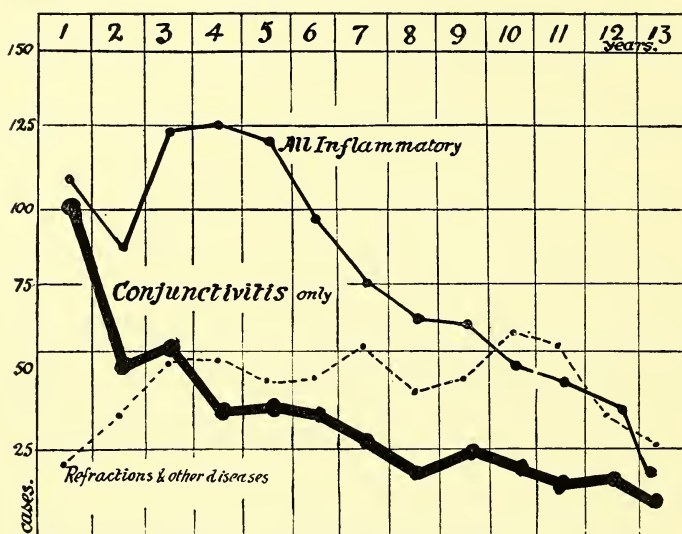


FIG. 4.—CASE INCIDENCE, BELGRAVE HOSPITAL. REFRACTIONS STEADY FROM TWO TO TWELVE YEARS. CONJUNCTIVITIS DECLINES THROUGHOUT.

The rise in the 'All Inflammatory' curve, three to five years, is due to onset of blepharitis and phlyctenulæ.

Sex and Sex Age Incidence.

It will be of interest to similarly examine the incidence of eye conditions in the sexes, first for males and females of all ages, and then in the different age-groups. The figures in the charts of this section are corrected to the

constant of 'other diseases,' a group found to bear similar proportions in males and females; so that this comparison is free from the usual fallacy of sex incidence comparisons in hospital statistics, arising from the fact that more women attend hospitals than do men.

Let us take the three big groups of cases—surface inflammations (conjunctivitis, blepharitis, phlyctenulæ, and superficial keratitis), injuries, and disorders of refraction. Fig. 5 shows how the incidence in these

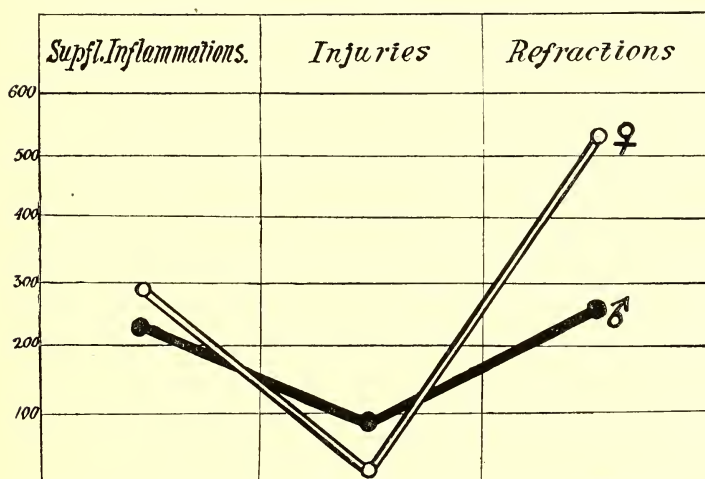


FIG. 5.—THE RELATIVE INCIDENCE OF INFLAMMATIONS, INJURIES, AND REFRACTION CASES FOR MALES AND FEMALES (MOORFIELDS CLINIC, 1902).

three conditions varies. Women suffer more from inflammations of the superficies of the eye than do men, despite the fact that they are less liable to injuries of the eye. This observation will be particularized and in part corrected when we examine the incidence in relation to the age-groups. Similarly, we note a much greater number of refraction cases amongst the women than the men.

An examination of the incidence of surface inflammations amongst school-children shows a similar sex relation. Amongst 21,893 children aged from seven to thirteen years, there were found 351 cases of disease ; of these, 203 were in girls and 148 in boys. The proportions of the sexes in the schools examined were almost equal.

When we make a more detailed examination of the sex incidence of the Moorfields cases in each age-group, the results appear most instructive. Fig. 6 may look a trifle complex, but it is well worth a little study.

There are three pairs of curves :

1. All superficial inflammations.
2. Injuries.
3. Refractions (and squints).

1. The Curves of Inflammation show in general the features already noted—a general decline from youth to age. But there is a variation in the rate of decline in the two sexes. Whereas in bulk the females have a greater incidence than males, in the working years of life, and particularly in the mobile years of the young adults, the males suffer more than the females. The reason for this is doubtless to be found in the curve of injuries.

2. The Curve of Injuries.—Baby boys suffer slightly more than girls, so do boys at school. In the mobile years of young adults the women suffer little, but the males show a very high incidence. This higher incidence in the male is, without doubt, due to the risks attached to their more active occupations, and to the same cause must be assigned the increased liability of males to inflammatory conditions during the same period of life. The divergence in incidence is less in adults ; whilst with the elders the females suffer slightly more than do the males.

3. **Refraction Curve.**—In infants the incidence (squints only) is equal in the sexes. There is an enormous incidence of these cases in school-children, but the sexes show little difference. In succeeding years, especially

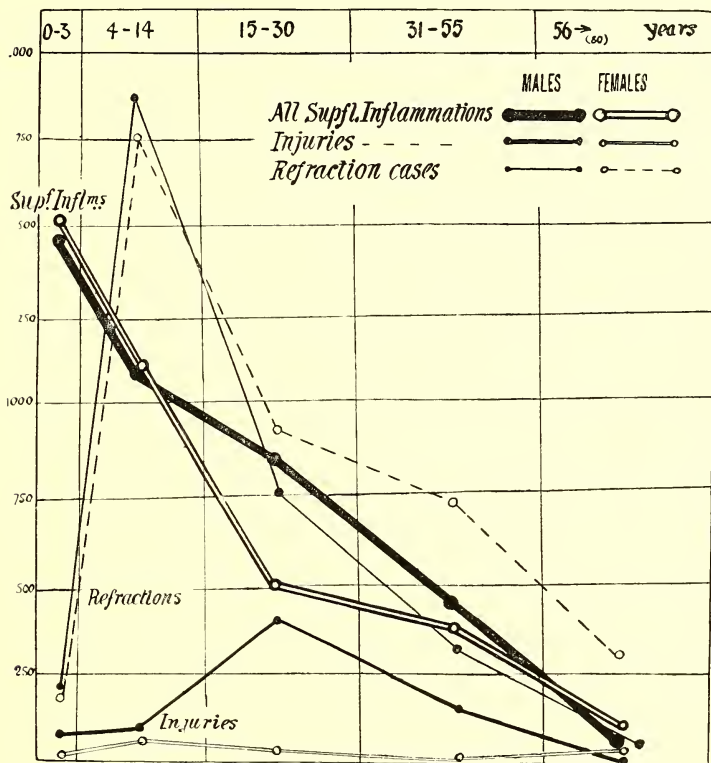


FIG. 6.—THE RELATIVE INCIDENCE OF INFLAMMATIONS, INJURIES, AND REFRACTION CASES FOR MALES AND FEMALES IN AGE-GROUPS (MOORFIELDS CLINIC, 1902).

in adults, females show a greater incidence of cases than males; doubtless the amount of needlework done by them requires the correction of small errors of refraction and accommodation.

The Influence of the Season of the Year on the Incidence of Inflammation of the Conjunctiva.

Two figures are given showing the results of examining the cases at the Belgrave and the Moorfields Hospitals. Fig. 7 of the Belgrave Hospital shows that more children attended the eye department in the first quarter of the year than in any other, and that the proportion of refraction cases was then at its highest; but, on the con-

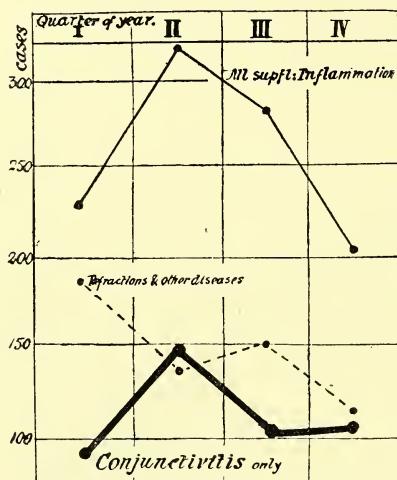


FIG. 7.—THE INFLUENCE OF SEASON OF YEAR ON EYE CONDITIONS (BELGRAVE HOSPITAL FOR CHILDREN DURING TEN YEARS).

Conjunctivitis is at a maximum in the spring quarter, in contrast to refraction and other diseases, which are highest in the dark winter quarter.

trary, there were fewer cases of conjunctivitis than at any other time. It does not look as though there was much basis for the popular idea that folk 'catch cold' in the eye. In the second quarter of the year conjunctivitis reaches its maximal incidence, whilst refraction cases fall near their lowest point.

Fig. 8 shows the results of the examination of the Moorfields cases. The curve shows the same feature as does the curve of the children. Cases are most numerous in the second quarter of the year; the sexes separately show similar curves, the incidence in the second quarter being most pronounced in females.

It is clear that conjunctivitis is most common during

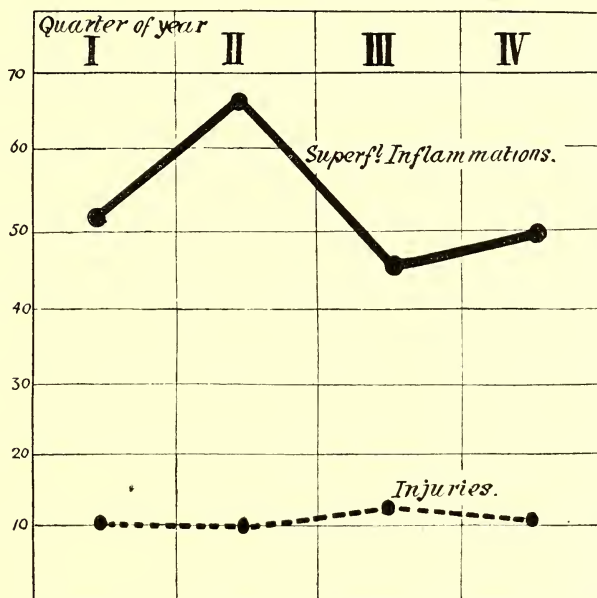


FIG. 8.—THE INFLUENCE OF SEASON OF YEAR ON EYE CONDITIONS (MOORFIELDS CLINIC, 1902).

Surface inflammations are at their maximum in the spring quarter. Injuries are constant throughout the year.

the months of April, May, and June. It is in the windy, dusty season of spring and early summer that conjunctivitis excels. The dung and dirt of the streets is blown about into every eye; innumerable septic foreign bodies find lodgment on the conjunctiva.

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This fact has to be borne in mind when stress is laid, as has sometimes been done, on the essentially diphtherial character of 'membranous conjunctivitis,' on account of its greater prevalence in the months when faucial diphtheria is prevalent; for, as is shown by these figures, all conjunctivitis is rife at the same season.

The Influence of Social Condition on Eye Conditions.

I will first give the results of the examination of a large number of schools in the Hackney division of the London County Council area, and a comparison of the incidence of disease in the different classes of schools therein. Between the months of July and November of 1903 I examined thirty schools, with 21,893 children, of ages from seven to thirteen years. The schools were classified according as I judged the general situation of the region, the housing, and the condition of the children favourable to their well-being. Thirteen schools were found in which the children reached a fair average of cleanliness, three schools were above the average, and fourteen below. The reports of the eye conditions of the children in these schools I had already made up. They were collected, and the following results appear :

Cleanliness.	Cases of Disease.	Percentage.
Above average ..	19 in 2,174	0·873
Average	134 in 9,463	1·416
Below average ..	197 in 10,256	1·92
Totals ..	351 in 21,893	1·608

The 'clean' schools were situated in the north of Hackney, where good housing and many open spaces are found; the 'dirty' schools in Hoxton, Haggerston, and



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Bethnal Green, where are miles of mean streets crowded with humanity. Those schools above the average of cleanliness had an incidence of disease of about one-half that found for the schools below the average of cleanliness, yet it must be remembered that no one of the best schools was without some dirty and ill-kept children, for in every part of London is found some 'slum' street which breeds its quota of dirtiness.*

I have before stated that amongst the patients attending the Moorfields clinic were many alien immigrants, whose conditions of life before reaching this country had been as bad as could well be, and to judge by their general appearance, their habitat was not materially improved by their change.

In examining the case-papers, native and alien patients were classed separately ; the separation was made solely by the name of the patient. Experience enables one readily to make this judgment. Any uncertain cases were classed as native, and this, with the inclination of some of these immigrants to anglicize their names, throws any error in the distinction on the native side of the balance. On the whole, I judge the general con-

* Summary of eye disease in 21,893 Board School children, 1903 :

- Simple conjunctivitis, 10.
- Follicular conjunctivitis, 14.
- Muco-purulent conjunctivitis, 10.
- Trachoma, 3.
- Blepharitis :
 - Slight, 26.
 - Moderate, 210.
 - Severe and chronic, 24.
- Phlyctenulæ, 53.
- Lachrymal abscess, 1.
- Effects of ophthalmia of newborn, 5
- Interstitial keratitis, 5.
- Congenital anomalies, 14.
- Eyes lost, 7.

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dition of life and cleanliness of our native patients to be superior to that of our alien patients. I found 2,124 native patients and 627 alien. The incidence of the various eye conditions amongst them were as follows :

Conditions.	Cases.		Ratio.	
	Native.	Alien.	Native.	Alien.
Conjunctivitis ..	321	231	3	+ 2
Trachoma ..	11	22	1	2
Phlyctenulæ ..	42	14	3	1
Blepharitis ..	48	63	4	+ 5
Injuries	180	8	22	1
Refractions ..	1,202	240	5	1
Other diseases ..	320	49	6	1
Totals ..	2,124	627	3·5	1

The foregoing figures are striking enough as they stand ; they show that, case for case, the dirt diseases are more frequent amongst the poor alien than the native. But it will be well to compare these totals in the same manner as has been done in the examination of incidence as affected by age, sex, and season—*i.e.*, refer the figures to the constant of ‘other diseases.’ The nature of these diseases does not suggest any greater liability in one or other class in any social or racial classification. The results of this computation appear in Fig. 9. There is no doubt about the conclusion. Conjunctivitis, trachoma, blepharitis, are all much more frequent amongst the alien than the native. Injuries alone are more rare amongst aliens, for the work they do is almost wholly sedentary. It will be noticed that the alien has a greater incidence of defective vision—refraction cases—than the

native : 490 against 373. The possibility of checking these results by those obtained by the individual examination of London school-children occurred to me. I

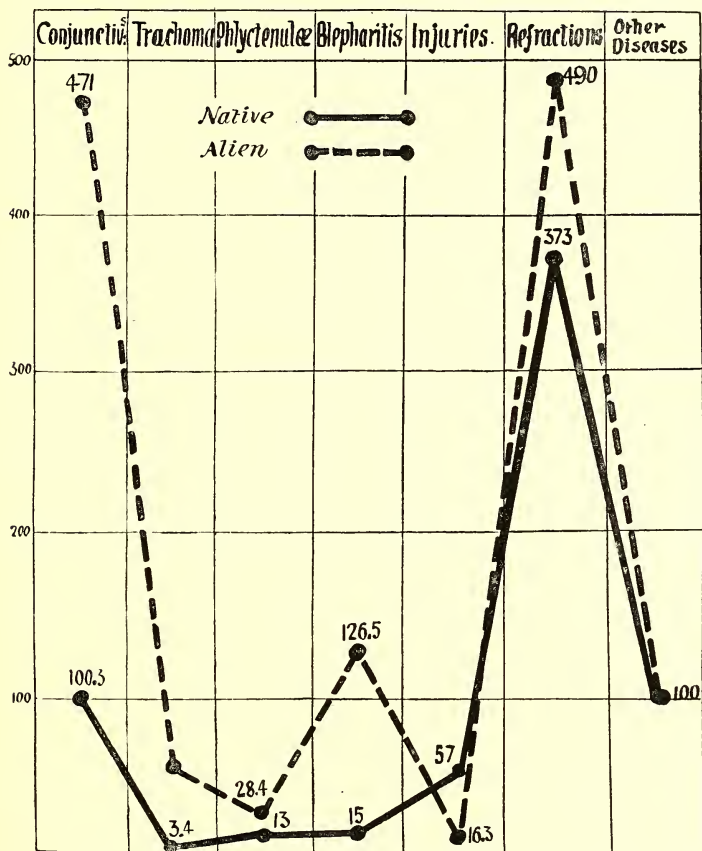


FIG. 9.—THE RELATIVE INCIDENCE OF EYE CONDITIONS IN NATIVE AND ALIEN PATIENTS.

All dirt diseases are more frequent in the poor, ill-kept aliens ; to injuries alone are they less liable than the native.

applied to Dr. James Kerr (the medical officer of what was then the School Board for London) for a return. He has kindly furnished me with the following :

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COMPARATIVE CONDITIONS OF VISUAL ACUITY OF CHILDREN ATTENDING THE SENIOR DEPARTMENTS OF ELEMENTARY PUBLIC SCHOOLS IN LONDON (SCHOOL BOARD FOR LONDON). (DATED DECEMBER, 1903.)

Group 1 : Jewish children, mostly natives of S. Russia and of Poland, and living within a mile of Aldgate.	Group 2 : British children living under very similar conditions as to density of population, etc., as the children of Group 1	Group 3 : London children of all conditions, local, social, and national. Average on 30,000.
Defective, 36 per cent.	Defective, 30 per cent.	Defective, 26 per cent.

The classes of patients at Moorfields placed in contrast are those similar to the children in Groups 1 and 3. My figures were : Alien, 490 ; native, 373. If each of these be divided by 14, we get 35 and 26·7 respectively, and the following is found :

		Alien.	Native.
Board School return	.. ..	36	to 26
My comparative return	.. ..	35	to 26·6

That is, the return I have put forward rather under-estimates the difference than otherwise. I do not think it would be possible to subject the method adopted of dealing with the Moorfields statistics—reference to the constant of ‘other diseases’—to a more severe test than is applied in this comparison of the School Board return and my computation ; and since the real and the comparative returns agree in one case, we may take it the comparative is true in all cases.

Conclusions.

The lessons told by these statistics, though they are gathered from such diverse sources, are distinct and clear.

The incidence of inflammatory diseases of the conjunctiva is found to be greater—

1. In infancy than in youth, in youth than in age.
2. In the female sex than in the male sex, with the exception of the mobile years of young adults, when the incidence is greater in males than in females, a liability synchronous with a marked incidence of injuries in the males.
3. In the warm, dry, sunny months of the second quarter of the year—April, May, and June—than at any other season of the year.
4. In the poor, the dirty, and the overcrowded, than in those whose conditions of life are relatively comfortable, clean, and open.

(In the sections dealing with the individual diseases curves will be given showing the relative incidence of each of these conditions in age or other important state.)

CHAPTER IV

THE CAUSES OF BLINDNESS

IN the years 1903 and 1904 I made a detailed examination of the children in the blind schools of the London County Council. Special note was made of the presumptive cause of the blindness. The second examination was made without reference to the findings of the first, so that my results were checked. The figures are those of the 1904 examination.

I saw 255 children—122 boys, 133 girls. Of these, 29·3 per cent. were absolutely blind ; 3·6 per cent. had pupillary reaction to light ; 34·8 per cent. perception of light ; 2·3 per cent. perception of fingers ; and 29·8 per cent. perceptions of letters (of any size and at any distance). The causes producing the blindness are shown in the table on the opposite page.

At the head of the list is the huge total of 94 cases, or 36·86 per cent. of the blindness, arising from the ophthalmia of the newborn. Great as is this percentage, it is in reality even larger ; for, by dint of careful treatment and operation, we have been able to relieve some hitherto blind, or practically blind, by reason of cataract, high myopia, interstitial keratitis, and trachoma, and by removal of these cases the percentage of blindness from ophthalmia neonatorum is increased.

Cause of Blindness.	Number of Cases.	Percentage.
Ophthalmia neonatorum	94	36·862
Congenital syphilis: Interstitial keratitis, 22; Uveal damage or optic atrophy, 26	48	18·823
Optic atrophy, other causes than congenital syphilis, or uncertain	22	8·627
Macula damage	3	1·176
Retinitis pigmentosa	5	1·96
Purulent ophthalmia	7	2·745
Small-pox	2	0·784
Sympathetic	7	2·745
Trachoma	2	0·784
Phlyctenular keratitis	3	1·176
Congenital defects:		
Cataract	22	8·627
High myopia	13	5·098
Microphthalmia	12	4·686
Hypermetropia (undeveloped macula)	2	0·784
Buphthalmia	4	1·568
Dislocated lens	1	0·392
Albino	1	0·392
Ill-shaped head:		
Hydro-, micro-, oxy-, acro-cephalic ..	6	2·352
Malignant disease	1	0·392

The blindness caused by purulent ophthalmia in later years is very little in comparison, only seven cases, or 1·96 per cent., being debitable to it. Small-pox, the old scourge of populous countries and the blinder of innumerable eyes, appears with only two cases, or 0·784 per cent. The two children blinded by this cause had not been vaccinated.

Next after ophthalmia neonatorum comes congenital syphilis, with a total of forty-eight cases, or 18·82 per cent. Again, this total is really smaller than it should be, not only from the same cause that affects the figures of the ophthalmia neonatorum—the removal of improved cases of other causation—but because there are many

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cases placed in the next group, 'optic atrophy from other causes,' almost certainly due to congenital syphilis, but which in the absence of absolute certainty I prefer to place apart.

In the next group, 'optic atrophy from other causes than congenital syphilis, or of uncertain cause,' are a heterogeneous collection of twenty-two cases, 8·627 per cent. Almost all are quite blind, or retain only some peripheral light perception. Several are undoubtedly meningeal in origin, others post-influenzal. Head injury possibly accounts for some; others are inexplicable in the absence of any history or other observable physical signs.

Sympathetic inflammation after injury to one eye appears with seven cases, or 2·745 per cent. This, I think, is a rather larger proportion than should be expected. It is a hard thing to remove an injured eye that might just be saved, perhaps with some vision, or, at any rate, with good *cosmétique* effects, but it is better to excise by over-vigilance a few possibly useful eyes than to allow one such case of complete blindness to occur.

Trachoma scarcely figures in this list. In 1903 I found three cases in one residential school—one a boy blind from optic atrophy, the others boys previously well-sighted. In 1904 I found two cases in a day blind-school, one partly blind from other causes. All were treated at Swanley, and recovered.

The case of the boy blind from optic atrophy is of special interest, since he was known to be healthy before the two other boys with trachoma came to the school. It seems very probable that he contracted the disease from one of them. From my observation of the habits of blind children, they would appear particularly liable to pass on contagious affections, owing to the habit of fingering their eyes.

Considering the enormous number of cases of phlyctenular keratitis and conjunctivitis which appear at hospital, there are but few cases blinded—or, rather, nearly blinded—by the disease; only three cases, or 1·176 per cent., were found. But these figures take no account of the vast number of eyes *spoiled* for really effective vision by the disease.

Congenital defects account for sixty-one cases, or 23·9 per cent. These are a heterogeneous collection of cases; lack of development accounts for most, but some are almost certainly due to disease.

A few have already been removed from the category of blind by operation for cataract and high myopia. One of these, a girl with 25 dioptries of myopia in each eye, was on the point of being treated as ‘mentally defective.’ I had her throat and nose cleared of adenoids, and then needled one crystalline lens. She now sees $\frac{6}{18}$ without glasses, and is a new girl.

Last on the list comes one child both of whose eyes have been excised on account of glioma.

The examination of these children shows that **more than one-third are blind from a cause that is preventable.** I shall suggest a possible mode of reducing this great group in the section on purulent conjunctivitis.

The Lot of the Blind.

The lot of the blind is now not altogether unhappy. Helpless blind beggars are becoming rare. The teaching of handicrafts and the use of the ingenious Braille system bring usefulness and the pleasures of communication and of reading to them.

One of the most difficult lessons to teach the children is ‘deportment,’ and particularly facial control. They

readily contract habits, various sorts of antics or contortions, and picking at the eyes, all of which are liable to become disgustingly ugly, and which, if carried into adult life, still further handicap the blind in their dealings with normal folk.

For these reasons the exclusive use of teachers who are themselves blind is not good. Blind teachers are invaluable in teaching the children the methods on which they themselves depend, but they cannot correct defects in carriage. There must be a percentage of normally sighted teachers in schools for the blind. The efficiency of such a mixed staff is admirably shown in many of the London County Council schools, and particularly in those where a system of simple drill and gymnastic exercises is taught.

Some of the children, in addition to their blindness, suffer from congenital disease in constitution or development, which is the determining cause of the blindness. To such children the association with intelligent children, whose sight has been lost from purulent inflammation at birth, brings some benefit.

CHAPTER V

BACTERIOLOGY

The Bacteriology of the Normal Conjunctival Sac has been frequently investigated, and, save for one exceptions, with such uniform results, that it did not at first appear to present a further field for profitable research.

The great differences I found in the social and age incidence of disease suggested that a *comparative* investigation would be of service—the examination of eyes in folk of different sex, age, occupation, and social position. This large scheme time and material did not allow. I have therefore carried out a more modest inquiry.

Two schools were selected—one situated in the north of London, newly built, well situated, amid comfortable dwellings, filled with clean and well-cared-for scholars; the other situated in the densely-populated district of Bethnal Green, an old building, within a district of poor cottages, model dwellings, and workshops, and filled with ill-kept scholars. The one school was above the average of cleanliness, the other was below the average.

The head-teachers selected groups of children as their average scholars who presented clean, healthy conjunctivæ. In each school fifty children were examined—twenty-five boys and twenty-five girls. They were chosen at ages of five, seven, nine, eleven, and thirteen years;

of each age five children. The weather on several days preceding the inoculations had been wet in the extreme, so that one common source of conjunctival infection in towns—street dust—was entirely eliminated. The lower cul-de-sac was gently stroked with a platinum loop, and the loop smeared on blood-serum. Not infrequently a sufficiency of secretion was wanting, so that to obtain a tear to fill the loop the nose had to be pinched.

Of the 100 conjunctivæ examined, 23 were sterile. Of the 50 boys, 13 were sterile; of the 50 girls, 10 were sterile. Of the 50 dirty children, only 3 were sterile; of the 50 clean children, 20 were sterile. Several of the sterile eyes I re-examined, and in most cases found them still sterile (6 re-examined, 5 sterile).

The totals of the colonies grown in all the cases show very well the differences in the incidence of micro-organisms in sex and cleanliness: Dirty groups, 789 colonies (boys, 359; girls, 430); clean group, 262 colonies (boys, 119; girls, 143).

As to the variety of organisms found, and the percentage of sterile eyes, my results are similar to those of Foot, Eyre, Gelpe, Lawson, Morax, Griffith, and others. The average of four of these workers is 27 per cent. sterile. There is, however, a wide difference between these and my results and the finding of Lachowitz. He found 69 per cent. of the eyes examined were sterile. Perhaps the solution of this divergence may be found in the lines of my work. The clean and dirty children differ widely in their percentage of sterile sacs. In the clean 40 per cent. were sterile, in the dirty only 6 per cent.; and these children were all in Board Schools, the best of which have many dirty children. Perhaps the subjects of Lachowitz examined were clean folk.

I had hoped to have examined the conjunctivæ of

some children in High Schools, but could not obtain the necessary permission; the masters were fearful of the parents.

COMPARATIVE EXAMINATION OF HEALTHY CONJUNCTIVÆ
IN SCHOOL CHILDREN.

ORGANISMS FOUND.	'DIRTY' GROUP.		'CLEAN' GROUP.		TOTALS.
	Boys.	Girls.	Boys.	Girls.	Highest attainable, 100.
					Times.
Diphtheroid bacilli (all forms)	16	11	5	4	36
Staph. pyog. albus ..	7	6	3	1	17
Staph. pyogenes flavus liqf.	1	—	2	1	4
Staph. pyog. citreus	—	2	—	..	2
Streptococcus longus	1	2	—	—	3
Streptococcus brevis	1	—	—	—	1
Bac. coli communis ..	1	—	—	—	1
Bac. Koch-Weeks ..	—	1	—	—	1
Bac. Morax-Axenfeld	—	2	—	1	3
Micrococcus pneumoniae (Fraenkel) ..	—	1	—	—	1
M. cereus albus ..	—	1	—	1	2
M. candidans	2	3	5	2	12
M. aurantica	—	—	1	—	1
M. roseus	—	1	—	1	2
M. diffuens	1	—	1	—	2
M. versicolor	—	—	—	1	1
Sarcina lutea	—	1	1	—	2
Sarcina alba	—	1	—	—	1
Bac. subtilis	1	—	—	—	1
Bac. lactis aerogenes ..	—	2	—	—	2
Bac. alvei.	—	2	—	—	2
Streptothrix (species ?)	1	—	—	—	1
Leptothrix buccalis ..	—	2	—	—	2
Penicillium glaucum	—	—	2	1	3
Bac. coprogenes parvus	1	—	—	—	1
Bac. aerophilus ..	1	—	1	—	2
A minute oval coccus (unidentified) ..	—	—	—	1	1
No. of varieties ..	12	15	9	10	28

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There are one or two points of interest in the varieties of organisms found. The diphtheroid group includes three specimens which, morphologically, would appear to be the Klebs-Loeffler bacillus, whilst most looked and grew like the Hoffmann-Loeffler bacillus. The xerosis bacillus was more frequently found in boys than in girls (21 to 15).

To my surprise, rich cultures of *Morax* bacilli were obtained twice in girls of the 'dirty' group. The children were re-examined a week later in the expectation of finding some inflammation, but there was none. In one clean girl a single colony of the bacillus was found. Koch-Weeks bacillus was found in a boy of the 'dirty' group, though his conjunctiva appeared quite healthy, and remained so for a week subsequent to the investigation.

These features of the greater incidence of organisms in the 'dirty' groups and amongst females are instructive. They coincide with the incidence shown by the statistics gathered from Moorfields and the schools. Surface diseases of the eye are more frequent in alien patients than in native, more frequent in women patients than in men, more frequent in 'dirty' schools than in 'clean,' more frequent amongst the girls than the boys.

The reason for this excess of parasites and of disease in aliens and in the dirty school-children is not far to seek : crowded quarters, dirty clothes and person, lack of facility, and perhaps most of all lack of the space necessary, for washing, allow of immense accumulations of micro-organisms, which are doubtless rubbed into the eyes. But why should the females show this consistently greater incidence of parasites and disease ? They live and move in the same houses as the men. Is it because they are comparatively more confined to the

house, so that light and air has less cleansing facility? I am inclined to think that the real reason lies with another factor: women, by their configuration, run a greater risk of soiling in their necessarily more frequent use of seated sanitary conveniences, appurtenances not too scrupulously kept amongst the poor. This, I think, explains the particular liability of females to be the hosts of some organisms which have a marked affinity with the organisms of alvine discharges.

The Bacteriology of the Lid Margins.

The flora of the lid margins was similarly examined in a number of healthy eyes, both to obtain some idea of the organisms thereon, and particularly to determine the difference, if any, of the condition in clean children and in the dirty. The headmaster of a school with children of average cleanliness chose out ten each of his cleanest and of his dirtiest children who had good eyes. One group were very fair representatives of boys of the class; the other group were dirty, and not a little malodorous from lack of washing. The looped wire was rubbed gently along the margin of the upper lid across the mouths of the Meibomian glands, and along the inner surfaces of the bases of the cilia of the same lid. The inoculations were made on serum.

All the inoculations resulted in growths. The number of colonies differed widely. In one smear there were as many as 250, in another only 4. By counting the total number of colonies of all cultures we learn very fairly the difference in the groups: Dirty group, 680 colonies; clean group, 610 colonies—a difference of 10 per cent. in favour of the clean children. Not very great, perhaps, considering one group were fairly well looked after, and

the other little, if at all ; but it must be remembered the children sat in the same classrooms, lived in the same district, and probably played together. If I could have made the examination in schools widely separated in place and condition, as was done in the examination of the conjunctivæ, the difference might perhaps have been greater.

The flora obtained differed considerably from that of the conjunctiva. The great majority of organisms obtained from the margins were *Staphylococcus albus* or *S. epidermidis albus*. There were a fair number of the aureus and subflavus varieties, and in one case twenty-five colonies of the Morax-Axenfeld bacillus. The colour-producing cocci, which are probably the more active factors in producing pustular inflammations, were more numerous in the dirty children than in the clean.

The Bacteriology of Inflammatory Conditions.

For the purpose of this work a complete bacteriological examination of diseased conditions has been made in 231 patients. All these cases were worked out in the eighteen months ending October, 1903. In most of these cases, especially when one eye was diseased and the other apparently healthy, the two eyes have been examined. In many cases the examinations have been repeated on one or more occasions. In all cases the primary inoculations were made on inspissated horse serum, and frequently inoculations were made on plain agar, blood-smeared agar, or other media in addition. As the results of this work are incorporated with the clinical descriptions of the diseases in question, it is not necessary to refer to them specifically here ; but notes may be made here on some points of clinical convenience.

Value of Film Preparations in Clinical Diagnosis.

Cultural methods take time. Media is not always available in the out-patient department of a hospital or in a private house. Film preparations can always be made; glass can be obtained almost anywhere. A smear of the secretion, either by direct contact or by means of a clean glass rod or Volkmann's spoon, is easily obtained if the orthodox platinum loop be wanting. For a stain, if nothing better be at hand, Stephens' blue-black ink, red ink (eosine), or, best, a fragment of an aniline violet pencil dissolved in water, will serve.

In a number of instances, when suitable apparatus was not at hand, I have collected and incubated discharges in finely-drawn tubes (Fig. 10). By placing the tube in



FIG. 10.—GLASS TUBE WITH ENDS DRAWN OUT FINE FOR COLLECTING SECRETIONS.

any warm place, or suitably protected in one's own pocket, the organisms multiply in the fluid, and most excellent film preparations can be made at any convenient time within a dozen hours, and the fluid can be used for subsequent inoculations on media.

I have discussed in each section the most important points of diagnosis by means of film preparations. My conclusion is that we may with reasonable safety make a diagnosis from film preparations of secretions or tissue scrapings, suitably stained with aniline dyes, by Gram's or by Neisser's methods, as the case may indicate, of the following organisms: The gonococcus; the pneumococcus; common cocci; streptococci, especially if the secretion be incubated in capillary tubes as described

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above ; Morax-Axenfeld bacillus ; Koch-Weeks bacillus ; and the grosser fungi, streptothricæ.

It is never safe to make any qualification as to the variety of diphtheroid organisms seen in 'membranous' inflammations. If these organisms are seen, and the clinical conditions are severe, the case should, in the interim of proper laboratory tests, be treated as a case of virulent disease.

Blood Cultures.

A note may be made on a point of technique in the preparation of blood media. Many of the organisms found on the conjunctiva can only be grown successfully when smeared on media with blood, and in my experience freshly-drawn blood is preferable. To obtain the necessary supply by pricking one's own or another's finger or ear is a matter of time and uncertainty : time is required to sterilize the part from which the blood is to be drawn, and there is uncertainty from the liability to accidental contamination of the extracted blood. I devised another mode both rapid and faultless. In all inflammatory cases the superficial conjunctival vessels are dilated and engorged with blood. If one of these vessels be pricked with a sharp sterile needle there is a sufficient flow of blood on to the conjunctiva. It can be mixed *in situ* with the pathological secretion, and transferred on the platinum loop to the culture media. The method is obviously speedy, there is no risk to the patient, and one is quite certain that no extraneous organisms are added to the mixed blood and secretion.

CHAPTER VI

CONJUNCTIVITIS IN GENERAL

Classification.—The perfect classification of inflammatory disease can only be formulated in a complete state of knowledge. With a full knowledge of the causes of the inflammation, there would follow naturally a rational nomenclature of the disease based on the determining cause. At present there are a few only of such correlations. Meanwhile, the simplest term which will distinguish a group of symptoms more or less naturally severed from other groups of symptoms is to be preferred. In the opinion of such a teacher as Huxley it was not even necessary that such distinguishing nomenclature should be explanatory ; but in these eye diseases we are favoured with an ample choice of descriptive terms, some of which are apt both in essential description and in conciseness.

Excluding local changes, phlyctenulæ, blepharitis, pterygia, and the like, the inflammations affecting the conjunctiva as a whole can be roughly classed in two groups :

1. Those which run an acute course, are catarrhal, and do not necessarily leave permanent alterations in the tissues. Within this group will come simple catarrhs, catarrhs of greater severity, even to purulent inflammations.

2. Those which run a chronic course, exhibit hyperplasia in a marked degree, and tend to leave permanent traces of their action. In this group trachoma is the chief exemplar.

Catarrhal Group.—There are few examples of inflammation where the typical features of the condition can be more clearly seen than in an affection of the conjunctiva. The delicacy and transparency of the tissues enable the observer to note every change with exactness. The sensibility of the tissues are such that the most phlegmatic of patients complains of pain, and will, unprompted, describe his sensations in terms similar to those used by the most neurotic of subjects. The close relation of secretory glands enables us to note the influence upon their metabolism of an acute disturbance of sensory and vasomotor nerves in their sphere of influence.

I have frequently watched the changes in the eye of a friend, and felt them in my own eye, when we have produced a transitory inflammation by the instillation of an irritant. A solution of $\frac{1}{2}$ per cent. of allyl oil in castor oil forms a most satisfactory irritant for this purpose. If the experiment be performed at night, the effects, except for some glueing of the lashes, are gone by the morning.

Redness, heat, swelling, pain, are features met with in every conjunctivitis.

The swelling may vary considerably, from a barely perceptible œdema to a swelling so intense as to render lids and globe immobile. The delicate fold of the plica semilunaris shares in the œdema, and becomes a much more obvious structure than under normal conditions. In the milder attack, when the lids are parted, it pouts forward as a bright-red puckered fold. In the severe attack it may be so involved in the general chemosis as to be no longer separable from the swollen conjunctiva.

The peculiarity of the pain complained of by the sufferers must be noted: a sensation of sand or grit beneath the eyelids. These similes have been repeated by such a long train of sufferers, their complaint has been noted by so many and such distant recorders, that there can be no doubt as to the universality of the sensation. The sensation cannot be due to the perception of exfoliated portions of the mucous membrane, or particles of mucous or muco-purulent material, as foreign bodies. It must be ascribed to the disturbance of the endings of the sensory nerves, which, being trained from the beginning to detect and report to the higher centres the presence of foreign bodies, report their sensibility of this inflammatory disturbance in the terms they are accustomed to—foreign bodies, grit or sand on the conjunctiva.

The proof of this can be found in the influence exercised by the application of a mild caustic solution. In the words of Mackenzie :

‘The feeling of sand is uniformly relieved, and the inflammation abated, by the use of a solution of silver nitrate. . . . I have sometimes alarmed other practitioners by proposing this . . . in the case of an eye highly vascular, affected with a feeling as if broken pieces of glass were rolling under the eyelids, and evidently secreting purulent matter ; and I have been pleased and amused at their surprise, when, next day, they have found all the symptoms much abated by the use of the application ’ (‘Textbook,’ p. 335).

The redness and heat are the result of the hyperæmia. They do not call for much remark, save to note that the unusual injection enables us to trace the course of vessels which would be otherwise difficult. The bright-red, easily-displaced vessels of the loose ocular conjunctiva,

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and the more dusky coloured and fixed vessels of the episcleral tissue are easily recognised. Not infrequently small hæmorrhages occur in the ocular conjunctiva about the loosely-supported superficial vessels, as can be easily demonstrated by temporally bleaching the eye with adrenalin.

The ancient belief that the heat of an inflamed part was due to an elaboration of heat *in situ*, and that it might exceed in degree the general body heat, has been too long exploded to need further comment. In a number of cases I have taken the temperature of eyes in the normal healthy state and when inflamed. This was done by slipping the bulb of a small quick-acting clinical thermometer along the lower fornix to beneath the external canthus.

The temperature of the conjunctiva in health varies slightly in different people. It ranges from about 3° to 4° F. below the body temperature.

Animal.					Axillary Temperature.	Conjunctival Temperature.
Cat	..	..	..	..	101·4	97·3
Dog	..	..	..	..	99·4	95·5
Dog	..	..	..	..	100·8	97
Man with subnormal range of temperature	..	..	..	..	97	93·2
Man with normal range of temperature	..	..	..	..	98·4	95
Man with high level of fever	..	..	..	..	102	101

In inflammatory conditions of the conjunctiva the temperature of the membrane rises to a near equality with the body temperature in proportion to the visible vascularity of the membrane. In mild chronic conditions, such as the angular conjunctivitis due to the presence of the Morax-Axenfeld bacillus, or in trachoma

without reaction, there was found no appreciable elevation of the temperature. After the application of some stimulating preparation in trachoma, such as blue-stone, the temperature would rise from 0.5° to 1° F. The same rise could be obtained in normal eyes when an irritating solution was instilled, such as an allyl oil or benzyl chloride.

In acute inflammatory conditions the temperature was much nearer to the general body temperature—to within 1° F., or in rare cases of much swelling of the eye to $\frac{1}{2}^{\circ}$ F. The thermometer never registered an equality with the axilla or mouth. Perhaps this may have been due to the lesser covering of the instrument by the lids than by the tissues of these other regions.

In one or two instances, in taking the temperature of my own conjunctiva, a slight reduction of the normal difference from the body temperature was obtained when the test was made after vigorous exercise. This is what one would expect from the greater peripheral circulation following exercise.

The conjunctival reaction has its effect on the condition of the neighbouring glands. The action on the lachrymal gland is most apparent in an excessive flow of tears. The Meibomian glands are stimulated to an excessive activity, witnessed by the white frothy secretion collected about the angles of the lids, particularly the outer angle. The intrinsic primitive glandular system of the mucosa, or the mucin secretory power of the individual cells, is greatly increased, and is shown both in the appearance within the lacus lachrymalis of little pledgets of mucus and in the excessive number of goblet cells found in microscopic sections of inflamed mucosa.

This marked activity of the glands is in great part due to the irritation of the sensory nerves of the mucosa •

setting up a reflex stimulation of the secretory nerves of these glands, for the association of these glands with the mucosa is the closest conceivable in ancestry, present topographical relationship, and in community of nerve-supply, sensory, secretory, and vasomotor.

In what degree the direct action of the irritating substance or organism producing the inflammation may be responsible for any of the excessive glandular activity is not easy to determine in the case of the Meibomian and intrinsic mucous cell glands ; but there can be little direct action on the lachrymal gland, else suppuration in its acini would be less a rarity than it is.

Of the utility of the hypersecretion there can be no question. The discharge of the goblet cells, the rapid loss of surface epithelium by the hyperplasia incident to hyperæmia, tends to remove the irritant influence, whilst the wash of the tears from the extreme of the upper fornix to the lacus carries the débris towards the effluent. The over-action of the Meibomian glands is less useful. Under all ordinary conditions the secretion has a sufficiently greasy consistency to keep the tears within the lids, but in inflammation the secretion appears to be thinner, more easily frothed, and to lose considerably in its greasy quality. With the excess of tears and failure of proper Meibomian secretion to protect the lid margins there is an ever-increasing tendency to excoriation of the skin about the lids, and these conditions act and react in a vicious circle.

In the simpler inflammations the conjunctival layers of the cornea suffer no appreciable damage. There is the same loss of surface and rapid growth of the epithelium as in the general conjunctiva, for flakes of corneal epithelium are repeatedly found in the secretion in film preparations. The irregularities of the cornea produced

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by these changes can be readily demonstrated by staining with fluoresceine. If after the application of the stain the cornea be washed with a drop or two of saline solution, and the fluid in the lacus be removed by an absorbent, the delicately-stained points of the roughened epithelium can be made out with a lens.

Then there is the effect of the inflammation on the drainage system of the eye. So long as the œdema of the lids does not displace the puncta lachrymalia and render them incompetent, an extremely severe inflammation of the conjunctiva does little damage to the greater channels. These suffer more commonly by their connection with the nasal passages. The eyes are much more frequently endangered by septic lachrymal passages than these latter from inflamed, even purulent, conjunctivæ. On occasions lachrymal abscesses do follow conjunctivitis. The sequence seems to be more frequent in the earlier inflammations of infants than in those of grown people.

Lastly, there is the impairment of vision. Excluding the most severe cases where the eye is closed by œdema, there is, even in slight cases, some loss of clearness of vision. By the suffusion of tears, the deposit of floating particles upon the cornea, and the greater or less degree of irregularity of the corneal epithelium, the cornea loses in efficiency as part of the optical combination of the eye. Symptoms not unlike those noticed when dust is within the eyepiece of a microscope are noted, save that in the eye the blurred spots are mobile, and move with every movement of the lids. Where a patient has already sustained injury or loss of one eye, such symptoms in the remaining sound eye cause much alarm. The symptoms are produced by the detritus upon the cornea casting shadows on the retina. The phenomenon is

made prominent when the patients look through a small hole in a card in the direction of some white surface (Stellwag, p. 371).

Group of Chronic Inflammation or Hypertrophy.—Of the second group of conjunctivitis cases, those which run a chronic course, exhibit hyperplasia in a marked degree, and tend to leave permanent alterations, nothing can be said in a general manner. Each presents such special features that they must be considered separately.

CHAPTER VII

SIMPLE CONJUNCTIVITIS

SIMPLE conjunctivitis does not differ materially from the preceding general description. It is 'simple' only in the mildness and the brevity of its symptoms. It may be so slight that little is noticed beyond a slight redness, pricking and stiffness of the lids at night, and a stickiness and crusting of the lids in the mornings. Nevertheless, all the metabolic changes described occur. There is even an access in the numbers of leucocytes in the conjunctival fornices, for though these are in such small numbers that they do not appear to the naked eye, yet they are found invariably in the microscopic examination of the secretion.

The causes which may induce such an inflammation are extremely numerous and widely diverse, from the invasion of a micro-organism to a mechanical irritant.

I have made bacteriological examinations of cases of simple catarrh wherein the nature and degree of the inflammation was such as not to suggest any specific diagnosis.

In forty cases examined there were found a variety of real and proximal causes. Amongst those of bacterial origin are some which from the organism found should be classed elsewhere. In one the Koch-Weeks bacillus, in

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another *Micrococcus pneumoniae*, were found, yet when the cases were seen there was no suggestion in the symptoms that they were of a serious nature, and, indeed, both cases speedily recovered on very simple treatment. In yet other cases the discovery of the *Streptococcus longus* suggested an association with lachrymal trouble, yet none could be demonstrated.

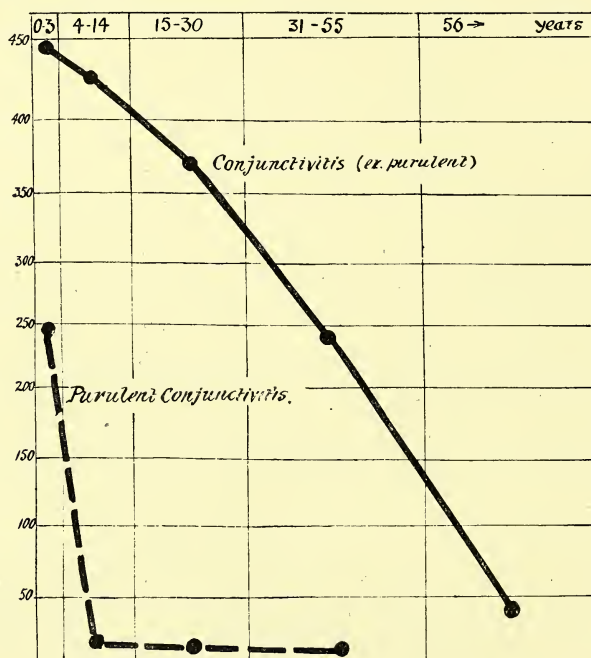


FIG. 11.—THE INCIDENCE OF CONJUNCTIVITIS.

Contrast the gradual decline in frequency of the milder forms with the sudden diminution of the purulent form. (Moorfield Clinic, 1902.) See also Fig. 20, p. 101.

Other cases were associated with *Streptococcus brevis*, *Staphylococcus pyogenes aureus*, *S. p. subflavus*, *S. p. albus*, *S. p. citreus*, a streptothrix, and sarcina. Could these organisms be considered the causes of the inflam-

mations they were associated with? That is a point which it is not possible to certainly determine. These same organisms have been placed in large quantities into the conjunctival sacs of animals without harmful results. I have rubbed into the sacs of guinea-pigs pus teeming with pyogenic organisms, either fresh from acute abscesses or after it had been incubated in the oven, yet no untoward symptoms followed. I have isolated the streptococcus from the conjunctiva in cases of acute facial erysipelas, and yet there was no conjunctivitis. It is probable—at least, in the inoculation experiments—that unless there is some abrasion of the surface, there is no place of rest where the organisms can settle and multiply. The constant movement of lids and globe, the secretion of mucus and tears, washes away the organisms faster than they can multiply.

It has been suggested by Eyre and others that the tears have a specific bactericidal action. It hardly seems necessary to expect such imposing properties of the tears; their diluent action is enough to account for our findings. Bacteria, with most other noxious plants, substances, and beasts, act most successfully when numerous and massed. The subcutaneous inoculation of a virulent organism into an animal may do little beyond causing local tenderness if the dose be very small, but increase the dose, and the beast will be slain. The chemistry of the tears does not suggest the possession of any direct action on living organisms, but there is no doubt of the reinforcement of the lachrymal secretion on the least irritation of the surface of a normal conjunctiva, and the noxious substance is proportionately diluted.

In a couple of instances where I had children weeping copiously on account of phlyctenulæ (their conjunctivæ were shown by control cultures to be sterile), a supply of

tears was drawn off in a sterile tube and run on to an agar slope freshly inoculated. No difference was to be noted in the growth of these inoculations and those of the controls which had not been bathed in tears. There is support for the idea of the washing power of the tears from other cases: in several smart catarrhs of the conjunctiva associated with other local and general conditions—*e.g.*, coryza, pharyngitis, acute gastritis, the irritation of alveolar abscess—the conjunctivæ were examined, and in each case found to be sterile. Further, it is remarkable how frequently the conjunctivæ of children suffering from phlyctenulæ are sterile. In all these cases the eyes are as liable to contamination from the air and hands as with normal folk, perhaps more so, by reason of hand-rubbing; but no organisms, dead or alive, could be demonstrated by film preparations or by culture.

Traumatism.—Besides these cases, a number of inflammations directly due to traumatism were examined.

The irritants were most variable—scratches by fingers or other object, coal-dust, sparks from engines, sawdust, road dirt, dirt from an old demolished house, lime-burn, burn with curling-tongs, splashes of vinegar, varnish, or turpentine.

Some of these were likely to be septic enough—what could be worse than the dirt from old houses, or coal-dust from mines and coal-yards, where there is rarely any sanitary provision?—and the results arising from them were bad. Other of the foreign bodies were likely—nay, sure—to be sterile, though most irritating and even destructive—*e.g.*, hot lime, varnish, turpentine, engine sparks. In all these cases the conjunctiva was sterile to all cultural tests.

Injuries from such irritants are serious in two ways: firstly, on account of the damage done by the irritants;

secondly, lest the nature of the irritation be not recognised, and more irritants be applied by way of treatment.

Potash burns are not common, except in the region of chemical factories. They differ from lime-burns in that the burns are rather more sharply defined, and in the absence of foreign matter from the fornices.

Acids, particularly vitriol, play a deadly part on occasion, though rarely in England. I have seen an accidental injury arise from this cause in a chemical laboratory by the bursting of a flask of hot sulphuric acid.

In this class may be mentioned irritation following exposure to steam, smoke, or fumes of chemicals.

The unpleasant effects of formaline vapour, and the still worse effects of osmic acid fumes, upon the mucous membrane of both eyes and nose are not infrequently discovered in the use of these reagents for histological purposes. The osmic vapour probably 'fixes' the surface layers of epithelium in the same effective way as it does a film preparation, and the destroyed epithelium being rolled up into pellets by the action of the lid, the irritation of the first action of the vapour on the nerve endings is continued. Washing out the conjunctiva and nose with a normal saline solution brings much relief.

Of the action of septic foreign bodies there can be no doubt. To the initial irritant action of the foreign body is opposed the reaction of the glandular hypersecretion, which tends to remove the invader, or, at least, wash it free of septic matter. If this sepsis be much or too vigorous to be dealt with by such natural means, or if a serious breach of surface be caused by the body, then the inoculation of the sepsis will be certain, and the character of the inflammation will be determined by the invading organism. To some extent the initial hyper-

æmia of the membrane will favour the growth of micro-organisms by increasing the warmth and moisture of the mucosa, especially during the hours of night, when the eyes are still and the lids sealed with exudation.

Reflex Irritations.—Among the reflex irritations to which the conjunctiva is subject must be mentioned the hyperæmia coincident on local eye stresses. It is an everyday experience that slight degrees of conjunctivitis are produced or prolonged by errors of refraction. Some of these errors—small degrees of astigmatism of axes ‘against the rule’—are so slight that one might be inclined to be sceptical of their power to cause so much trouble. A year ago I saw a lady, aged thirty-eight, who had had redness of the left eye for a year; there was in each eye 1 D. of myopia, and in the left a myopic astigmatism of 0·25 D., axis vertical. On wearing the glasses the redness of the left eye disappeared without any local application.

I made a couple of experiments on this point, one on myself, another on a relative. I have worn glasses for the past year, so arranged that the lens of one eye caused the eye to have an astigmatism ‘against the rule’ of 0·25 D. For the first few months I noticed nothing amiss. Later, in sunny weather, there was occasional spasm of the orbicularis of that eye. Recently, when reading and writing for hours together, I have got into a trick of rubbing the eye, almost unconsciously; the habit has been remarked by friends. In a relative, a lady who wore cylindrical lenses constantly, I surreptitiously shifted one of the lenses so as to alter the axis of the lens about 10 degrees; the other lens was not touched. In less than a fortnight the lady complained of headache, and redness of the eye on the side of the altered lens. The trouble promptly disappeared when

the glass was replaced correctly. These are doubtless extreme cases in rather neurotic folk, but they serve to point the moral.

There is evidence to show that similar local stresses produce symptoms which are often erroneously diagnosed as 'hay fever.' Cases where profuse lachrymation and other signs of catarrh of so marked a character as to involve the mucosæ of the whole of the trigeminal distribution occur in bright and sunny weather, sometimes every spring for years in succession. In some very marked cases of the kind I have found serious errors of refraction, particularly of a single eye, the other being nearly normal. The symptoms exhibited are directly comparable to the well-known physiological reflex of sneezing when the eyes are exposed to sudden and bright lighting. If this phenomenon be produced in eyes the optical combinations of which are well balanced both in each eye and for the two together, how much more will be the effect in eyes ill regulated and ill balanced? In these cases relief has followed the use of correcting glasses, whereas before such correction nostrums of all sorts had been tried in vain.

Another cause of slight but chronic conjunctival inflammation is to be found in reflex irritation from the nose, where there is a diseased or hypertrophied mucosa, and by no means infrequently by the use of nasal douches of too great strength.

Conjunctivitis associated with General Conditions.

Conjunctivitis is very commonly associated with acute facial inflammations. In erysipelas some œdema of the conjunctiva is not infrequent, and acute catarrhs have been observed. The connection does not appear to be

constant, for whilst in charge of troops on shipboard I tended some severe cases of the disease, but in no case was there more than the mildest catarrh of the eyes, and this seemed more the consequence of the gross facial œdema closing the lids than of any specific effect.

The exanthemata may produce most destructive inflammations. Putting aside the liability to blepharitis, phlyctenulæ, and the like, as sequelæ of the milder attacks, particularly of measles, there are inflammations which appear at the time of the eruptions, and may be dependent upon them directly. Small-pox at one time was accountable for the loss of many eyes, and even now claims its victims. Two children in one small blind school in the east of London had lost their eyes from this cause a couple of years ago. The eruption of small-pox in severe cases affects the mucosæ of mouth and nose, the eyes less frequently. Ulceration of the lower segment of the cornea is the most damaging of the lesser consequences. Some believe the location of the lesion indicates an inoculation from the affected skin to the most exposed part of the cornea, others that it is due to exposure only. Certainly I have seen similar lesions in severe typhoid and in meningeal trouble, when the motionless, slightly parted lids allowed the exposed lower corneal segment to become dried and infected by dust and micro-organisms, with consequent deep ulceration. Ordinary care would have prevented this sequence. But in small-pox the lesion appears less readily prevented, perhaps by reason of an onset by proper eruption of the conjunctiva or limbus, such as a phlyctenule or a true pustule. There is also a greater difficulty in keeping the eyes clean when so much purulent matter is on the face.

‘**Gouty Conjunctivitis.**’—I had heard of a conjunctivitis believed to be properly associated with a general gouty condition, but had been inclined to scoff at the idea. At that time I had never seen such a case, for they are rare in hospital practice; but during the last eighteen months I have seen at least six cases which have convinced me of my error. In folk, mostly well-to-do, of typically gouty habit, of florid or ‘beefy’ countenance, whose tissues show a marked tendency to chalky deposit in the Meibomian glands, ear cartilages, and about the joints, there occurs a slight, evanescent, and often-repeated catarrh. There is a conjunctival injection, most often confined to the lower lid and lower ocular segment; there is little or no discharge, and no disease of the lachrymal gland; there is frequent complaint of itching of the eyes. The symptoms pass off quickly, but reappear as speedily through many years. After many years’ duration, there is a distinct tendency to the production of a pouting of the lower lid by reason of the thickening of the subconjunctival tissue and drying of the skin of the lid.

No good is done to these cases by any energetic local treatment. All antiseptics are out of place, for I have found the conjunctivæ (except when ectropion had appeared) to be sterile in most cases.

Astringents are equally useless, for they are also irritating. On the hypothesis that the irritation might be due to the excretion by the conjunctiva of noxious acid substances in a manner known to occur in the administration of arsenic, I have used alkaline lotions of bicarbonate of soda, and I think with good effect. It goes without saying that the general health of the patient must be the subject of care and regulation.

Conjunctivitis from Local Irritation.—There are a

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number of other conditions in which conjunctivitis is produced, which need but a brief note.

The association of styes, Meibomian cysts, and abscesses with local inflammations of the membrane is common. Concretions of the Meibomian glands, minute dense yellowish-white bodies, which are soft to the needle in young subjects, but hard and gritty from calcareous changes in the old, sometimes cause chronic irritation. They may be readily removed with the point of a broad needle or of a Graefe's knife.

In the rare condition described by Leber as 'conjunctivitis petrificans,' there is the rapid formation of chalky plaques on one or more parts of the ocular or palpebral conjunctiva, or even the lid margins. No certain cause has been ascertained for the condition. It does not appear to result in any damage to the eye. The thin scales are easily removed by fomentations, but they recur again and again for many years.

Local calcareous degeneration of the cornea producing a band of whitish substance in the horizontal meridian is more frequently seen. A very severe conjunctival reaction follows the atrophy of the epithelium covering the rough chalky film. The irritation can be allayed by scraping away the calcareous band with a sharp spoon. In a case of this kind not only was the conjunctivitis relieved by this treatment, but an eye with useful vision was regained.

Primary syphilitic sores occasionally occur about the eyelids. In two cases seen recently in infants the internal canthus was affected; there was a mild conjunctival discharge. The condition was readily relieved on the healing of the sore.

Vaccinia of the eye may produce an extremely severe conjunctivitis, and endanger the eye, as in the case

recorded by Knaggs. Usually the reaction appears less intense. Cases are not common.

Pityriasis Ciliorum.—The dwelling of the *Pediculus pubis* on the eyelashes produces both blepharitis and conjunctivitis. Three cases in Jewish emigrants came in one day to the Moorfields clinic. In one, a woman, there was no reaction; in two children the redness of the conjunctiva was more marked than the blepharitis. The parasites occupied the upper lashes only. They were removed by combing the lashes with broad fixation forceps and the use of yellow ointment.

Molluscum contagiosum has been associated with inflammatory conditions of the membrane. I have noted several cases of such affection of the lids, and in one case, where as many as twenty-five elevations were counted, there was no conjunctivitis. I am inclined to think any reaction in the membrane is merely coincident, and not consequent.

In ectropion, whether primarily due to the swelling of an inflammatory attack or the distortion of scars on the face, the chronic exposure tends to produce inflammatory thickening of the conjunctiva and an exaggeration of the eversion. Yet in some extreme examples seen in work-house infirmaries, where the whole of the lower lid was unfolded by gross facial scarring, the exposed conjunctiva remained surprisingly healthy, and did not harbour any excess of micro-organisms.

Displacement of the lashes by such a rare accident as of a cilium becoming detached from its follicle and fixed in a punctum may by rubbing the conjunctiva produce a local inflammation and infiltration, but more common causes of trouble are the displacements by the spasmodic entropion of old people, the permanent entropion following scarring of the conjunctiva from earlier disease, or

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the districhiasis of the multiplication of faultily placed lashes in a chronic hyperæmia of the lids (Raehlmann). All are responsible for irritation and injury to conjunctiva or to cornea, and must be dealt with directly for the relief of the membrane.

Nowadays the operation of paring the lids to remove the lashes is rightly never practised. The results are miserable in the extreme, for the hard, thin cicatrix of the incurved lid margin forms as objectionable a scraper as the displaced hairs. Transplantation can be well and certainly effected by many operative measures.

In cases of old conjunctivitis the formation of bands, and symblepharon of various degrees, may keep up a constant irritation. Cases occurring in this country are generally the result of burns from caustic alkalies, or as sequelæ of pemphigus. In India Herbert has shown that bands of lesser degree are frequently found without any other history than that of foreign bodies. Similarly, I have seen them in South Africa either alone or in conjunction with pterygia. These bands have to be dealt with operatively.

Inflammations in Anophthalmia.

Inflammations are of frequent occurrence in empty eye sockets at any period following the removal of the eyes. The mucosa is liable to the ingress of the same micro-organisms as the normal eye; but the empty socket is even more than the normal eye subject to such infections, for, owing to the falling in of the lids in the absence of the supporting globe, the lashes, which are crowded with organisms, come into contact for long periods with the warm, moist mucosa. If a shell be worn this liability is removed during the use of it, but there arise a whole

series of disabilities from the use of even well-fitting shells, and much more from ill-fitting specimens.

These risks may be reduced by certain measures : (1) Frequent irrigation of the socket ; (2) the use of a shell small enough to allow the lids completely to cover it with each blink ; (3) the careful washing of the shell free from grease at least once a day with a weak alcoholic solution ; (4) the use of two shells in alternation, so that liability to damage from irregularities of the shells is reduced by a discontinuity in their usage.

Patients yearn for full round shells that will show a prominence equal to that of the normal eye, but the *cosmétique* effect of such large staring shells is bad, and their influence on the mucosa worse. The continually exposed intermarginal portion of the shell becomes crusted with dried secretion, and affords a breeding-place for organisms. The pressure of the shell edges sets up inflammation, producing large swollen 'granulations,' followed by cicatrices and bands, which make the use of any shell a difficulty.

Recently I saw a nurse in a Poor-Law infirmary who had lost an eye from purulent ophthalmia contracted from a patient. The discharge from the socket was a continual trouble. She had six shells, but none would fit. Examination of the socket showed all were equally bad, for there were adhesions to the frontal bone, and so much scarring that a flat, wall-like surface was produced, against which a bone button would have been a better fit than the sharply-curved shells she used.

The difficulty was solved by making a model of the socket. The space was greased, filled with plaster of Paris powder, and wetted and mixed *in situ*. In ten minutes the mould was removed, and found good. It was now treated just as one would a piece of tissue for

histological examination. It was dehydrated, 'cleared,' and soaked in hot paraffin wax. When saturated, it was removed, and dipped again and again in the melted wax to increase its size in parts, especially over the 'corneal' surface. After a little adjustment by such dipping (at the infirmary a heated spoon and candle wax served) the model fitted excellently. The appearance was good (a sketch of iris and pupil had been embedded in the surface wax), and the lids closed over perfectly with each blink. The model was copied in duplicate by the makers, and there has been subsequent comfort, notwithstanding the scarred state of the socket.

This simple procedure can be repeated by anyone with a little plaster, alcohol, chloroform, and candle wax melted in a spoon. It will bring comfort in many a difficult case.

CHAPTER VIII

CONJUNCTIVITIS ASSOCIATED WITH DISORDERS OF THE LACHRYMAL SAC

THIS frequent association demands separate notice. In examining the case-papers of the Belgrave Hospital, I was surprised to note the frequency with which lachrymal abscess appeared in the first few months of life, particularly the second and third months. In one such case I investigated there had been repeated attacks of conjunctivitis of no great severity, beginning a few days after birth; it had been thought to be an ophthalmia of the new-born. First one eye was attacked, then the other. At last an acute abscess of foul-smelling pus formed in one lachrymal sac. The organism present was the *B. pyogenes fætidus*, a bacillus belonging to the colon group, in pure culture. I found members of this group in not a few cases of disease and in some normal eyes; in one case the *B. coli communis* isolated was inoculated by abrasion into the eyes of a couple of rabbits: both died, one in twenty-four hours, the other in forty-eight hours; the organism was recovered from the conjunctiva. These organisms may readily be expected to obtain access to the conjunctiva by direct inoculation of fæcal matter, either at birth from the mother, or later from the discharges of the infant. Doubtless in later

life road dust blown about by the wind will account for the conveyance of the organism, but in the examination of healthy eyes which I made this could hardly have been so, since the weather was excessively rainy.

Another frequent class of cases of this kind occurs in elderly women. I say women, because all the cases of the kind I have notes of are in women. In these the *Streptococcus longus* is almost invariably found, either alone or in association with the *S. brevis*, or with a staphylococcus.

Grosser fungi, as the streptothricæ, are not rarely obtained from the lachrymal sac. They are probably harmless parasites. Any irritation induced by their presence seems rather a mechanical than a pathogenic effect, for the irritation subsides on removal of the organism and washing out the sac with simple lotions.

These lachrymal obstructions and inflammations are in themselves a trouble, but their real danger lies in the constant menace they present to the contiguous conjunctiva, and particularly to the cornea, and so to the integrity of the eye. The smallest abrasion of the cornea may be infected, or operative measures, if performed under these conditions, may be disastrous.

I made cultivations from a series of cases of conjunctivitis with corneal ulcers, of which several were of this order. In one the *B. coli* appeared to be the determining cause, in another the pneumococcus, in others staphylococci only. The pneumococcus is credited with being the cause of most of these serpiginous ulcers, next in frequency to the *Staphylococcus pyogenes albus*.

The danger points to the necessity of re-establishing the health of the lachrymal sac at the earliest possible time by careful and repeated syringing. Failing this, and with long-standing distension of the sac and im-

pervious duct, the sac had better be completely excised, rather than risk the loss of the eye. Operation is especially indicated in the case of workmen exposed to the risk of injury from foreign bodies.

PNEUMOCOCCAL CONJUNCTIVITIS.

The pneumococcus of Fraenkel has been found in some few cases in the normal conjunctival sac. Cuenod, Guasparini, Lawson, and Griffith describe it: Lawson twice in 200 cases, Griffith twice in 210. In one instance amongst my 100 children the organism was present.

Several epidemics of conjunctivitis in which the organism has been the causal agent have been described. They have occurred in France, Germany, Russia, Switzerland, and America. Paris (Parinaud and Morax), Berlin (Brecht), Königsberg (Junius), Würzburg (Bach and Neumann), Rostock (Axenfeld), Sarasdorf (Alder and Weichselbaum), Philadelphia (Veasey and De Schweinitz), New York (Kibbe), Lausanne (Gonin).

There does not appear to have been anything like an epidemic of this nature in England, but sporadic cases have been reported as occurring both in young and old. The reaction is usually mild, and except for the bacteriological diagnosis, there is no distinguishing feature. This mildness of clinical symptoms is rather surprising, considering how distinctive is the lesion produced in the lungs. Probably the organism is attenuated, as is so commonly the case with organisms in the conjunctiva.

In only three cases (uncomplicated with corneal conditions) did I find the organism out of 230 cases examined. In one case there was no more than a simple mild reaction, and in the absence of muco-pus it was classed as 'simple conjunctivitis.' Film preparations showed a

fibrinous secretion. Another case had the clinical features of 'membranous conjunctivitis,' and a further one those of an ophthalmia of the new-born of mild degree.

The recognition of the organisms in the secretions or tissues of affected parts is not difficult, owing to the elongated pairs and the capsules around them. Care has to be exercised, as other ordinary cocci sometimes present a slightly encapsulated appearance. The recognition of the organism is not so certain in cultures. The delicate clear colonies are imitated by the *Streptococcus brevis*, and in film preparations from media the pneumococcus is frequently seen in short chains, and most often without capsules. The diagnosis is only made certain if the organism be inoculated into some small and feebly resisting animal, such as the mouse or white rat ; then the typical capsular form can be regained. Recently Gordon has published details of a method whereby the capsule formation may be obtained in cultures. The organism is inoculated on 12 per cent. gelatine and incubated at blood heat. Film preparations from the growth in the melted gelatine exhibit characteristic capsules ; streptococci grown under similar conditions do not show capsules.

CHAPTER IX

BLEPHARITIS

BLEPHARITIS is one of the commonest of eye diseases amongst children. Of the 351 cases of disease noted amongst 21,893 Board School children, 270, or nearly two-thirds, were varieties of blepharitis. The cases of the Moorfields clinic demonstrate this remarkably. The ratio of cases in the age-groups are: Infancy (to three years), 300; school age, 259; young adults, 45; adults, 10; elders, 2. After school years there were few cases, and those which appear in the adult and elders groups were old and chronic cases. Reference to the Belgrave cases gives details of the incidence amongst children (Fig. 12). Only one case was noted in the first year of life during a period of ten years. Cases began to appear with frequency at the age of three; they attain a maximum at the age of four years. It is to be noted that at the age of three or four years children of the class who made up the patients of the old Belgrave Hospital in Pimlico joined the infants' classes of the elementary schools. Community of subjects, with the ready transference of micro-organisms allowed by it, is probably the determining cause of this age incidence. Perhaps also 'eye-strain,' induced by the first attempts at kindergarten work, may be an adjuvant, since infants

tend to hold their work at a very short distance, and rub their eyes with their fists with great vigour and frequency when tired. The suggestion may appear to be borne out by the second rise in incidence at the age of eight years, the time at which most of the children are passed from the infants' department to the upper schools for boys and girls; then their eye-work is increased, and there is a simultaneous increase in the incidence of refraction cases. In the ten years during which these patients attended hospital there was no systematic

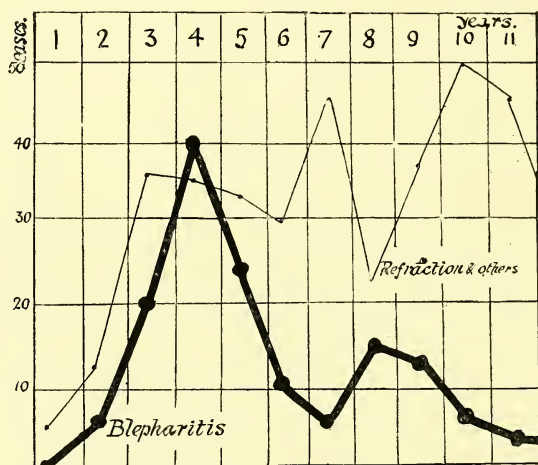


FIG. 12.—THE AGE INCIDENCE OF BLEPHARITIS.

Maximum incidence at the age of four years; children join the infant classes of elementary schools about the age of three or four years. (Belgrave Hospital for Children, ten years.)

visitation of schools for the investigation of the vision of the children, so the curve of refraction cases may be taken as a natural one—that is, those children who could not see with comfort or in whom some defect of vision was noticed by the teachers were alone brought to hospital. The selection was made by the experience

of the discomfort of a disability, and not, as is now, by the failure to attain a certain standard of vision.

As I have indicated in the section on general anatomy, the eyelid is to be regarded as a fold of integument the structures of which are adapted for special purposes. This specialization is marked at the lid margins. The hair is strengthened and set in rows as the outer guards of the conjunctiva ; the sebaceous glands are enlarged and similarly set in a row to discharge on to the very margin of the lid, so as to protect by a natural unguent surfaces which are being continually brought into contact, and by a natural waterproofing to form a boundary which shall prevent the overflow of tears on to the face.

The health of these marginal structures and the tissue about them is affected with the health of the skin of the lids and the conjunctiva. In general, the margins recover from inflammations almost as speedily as do these contiguous structures. There are however, a numerous class of cases in which the lid margins suffer a chronic inflammation of a peculiarly unsightly nature, and ultimately of a very destructive character.

The acute form of blepharitis is almost always the result of inflammations of the skin or conjunctiva—the former in the exanthemata, erysipelas, abscesses, and the like ; the latter either in conjunction with the skin conditions or in inflammations of the conjunctiva alone. The changes in the margins in these acute conditions are not different to those described under the section on general conjunctivitis, so need no further notice, save to add that such acute affections not infrequently initiate chronic changes in susceptible subjects.

In the chronic form the onset may have such a definite association with an acute attack ; but by no means infrequently—indeed, probably in the majority of the cases

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of the kind I am about to describe—the commencement of the affection is so quiet and insidious that it is not noticed by the patient. It is only when the condition becomes so advanced as to be remarked by the sufferer or others that the desire of human nature to ascribe every effect to a cause leads to the formulation of a definite ‘previous history,’ though the assigned ‘cause’ may be *post hoc*, and by no means *propter hoc*.

In examining children, I have found it possible to demonstrate every stage of the disease in a single large school. In the earliest stage there is only a little dry, white, bran-like material fixed on to the lashes, just like papers on a file. If these cases be seen late in the day, after much reading, and particularly after doing fine needlework, the margins of the lids will be pink in hue instead of the normal yellowish white. Later the injection of the margins—‘the weakness of the eyes’—is noticed all day long. There is redness, swelling, and tenderness of the margins, the lashes are crusted with dried secretion, débris of cells, and foreign matter. There is an alteration in the secretion of the Meibomian glands, so that the edges of the lids are not efficiently greased, and this, with the excessive lachrymation produced by the local conjunctivitis, allows an overflow of tears.

As the crusts accumulate on the margins, there succeeds an ulceration of the surface beneath them, disease of the hair follicles, with loss of cilia, and a chronic irritation of the Meibomian glands, followed by their ultimate destruction. The excoriation of the integument of the lids on the one side, and of the conjunctiva on the other, enhance the ever-present liability to an outbreak of a general conjunctivitis on even slight provocation.

The chronicity may be such as to induce a hyperplasia

of the fibrous basis of the cutis vera, producing numerous sessile fleshy knobs along the lids (Fig. 13) ; but in most cases the process drags out a miserable course for years, until there is left a soft, smooth, pink, pouting, rounded edge to the lid. The margin has become completely atrophied as regards the proper constituents of the region. The skin now passes into the conjunctiva by imperceptible gradations of epithelial thinning, and the cutis vera is replaced by a felt of soft scar tissue.



FIG. 13.—THE EFFECTS OF CHRONIC BLEPHARITIS.

I.D., Jew, æt. 19. Duration, 7 years. 1·25 D irregular astigmatism. Thick greasy skin with numerous 'black-heads,' coarse blue-black hair, very dirty in person. The upper palpebral margin has a row of semi-pedunculated fibrous growths. The lower lid is everted and raw. The cilia are almost gone.

In studying cases of this disease there are to be noted three outstanding features :

1. The subjects of the affection are most frequently possessed of skins and hair which are both thick and coarse. They are folk who either exhibit, or are found to be liable to, 'black-heads,' pustules, acne, and seborrhœa. There is, then, a susceptible **soil**.

2. The subjects of the affection will, on the objective

examination of their refraction, most commonly be found to show an error, generally of an astigmatic variety. There is in this factor a **preparation** of the soil.

3. Lastly, there is the never-failing presence, in even the cleanliest of persons, of pyogenic organisms about the lid margins—always the *Staphylococcus pyogenes albus*, very often the *S. p. aureus*, and not infrequently other organisms in addition. In twenty children with healthy eyelid margins bacteriological examination demonstrated large numbers of organisms in each case. There is, then, plenty of **seed** ready to hand for sowing.

It is not difficult to link into a connected story the relations between this susceptible soil, the preparation of the soil, and the seed. The clue, to my mind, lies in the second factor, the preparation of the soil. The defect in vision may be very slight, but when the child is put to close and difficult work, especially when from unhealthy general conditions of life fatigue is readily induced, the tiring of the eyes, the suffusion of tears, cause repeated blinking, so that the margin of the lids tap, tap, tap against each other with far greater frequency than is normal. The soil, naturally susceptible, is slightly irritated by the mechanical stimulation, and prepared for the reception of the seed, which probably makes its first implantation in the hair follicles.

The seed will flourish in direct proportion to its plentifulness—that is, in proportion to the dirtiness of the child's surroundings and person. This is eloquently shown forth by the statistics gathered (1) from the Board Schools, in the comparison of the incidence of the disease in schools where the children were above average, average, or below average in cleanliness: the last, the dirty ones, suffered most severely. (2) In the comparison of native and alien patients at Moorfields: although the relative number

of alien patients to native was as 1 to 3·5, the alien presented one-third more cases of the disease than the native. With the alien there is more frequently the susceptible soil—the thick greasy skin and coarse hair of the Southern melanochroi, in contrast to the thinner skin and finer hair of the Northern xanthochroi. Also in the greater overcrowding of the alien poor there is a superabundant provision of seed.

In subjects better circumstanced there may be both the susceptible soil and the preparation of the soil, but their greater cleanliness so reduces the seed that the occurrence of blepharitis amongst them is rare, and when found is of but slight degree.

CHAPTER X

ANGULAR CONJUNCTIVITIS

A MILD but chronic conjunctivitis, ascertained to be produced by the invasion of a specific micro-organism—the diplo-bacillus of Morax and Axenfeld. The name ‘angular’ is most apt: it emphasizes one of the most characteristic features of the complaint—the raw-looking skin about the angles of the lids (Fig. 14).

The conjunctiva is injected in a smooth, even manner, particularly over the lower lid and both fornices. There is no coarse dilatation of the vessels of the ocular conjunctiva; there is no great increase of secretion.

It is rare in the uncomplicated form—and this catarrh is most often uncomplicated—to find pledgets of mucus in the lacus. More commonly the secretion is seen to contain many minute bubbles, so that it appears as would a solution of egg albumin when churned up by blowing air into it through a fine tube. For the mildness of the complaint the blinking of the lids is noticeably excessive; in some cases the rate was timed to range from 100 to 200 per minute. It is this constant movement of the eyelids which produces the bubbling of the secretion.

The blinking is not only excessive in frequency, but also in vigour, for the lids are repeatedly screwed up tightly.

To this, I think, is due the rawness of the skin about the canthi, for it will be noticed that these surfaces are brought into apposition with each vigorous blink, and that the secretion is squeezed out between them. It is also possible that the organism has a peptonizing action on the tissues, even as it has on the nutrient serum medium of the bacteriological laboratory.

From my general impression of hospital cases I had thought the complaint was almost exclusively confined to women, but the noting of cases as they occurred showed this was not so. Cases were seen in both sexes,



FIG. 14.—CASE OF ANGULAR CONJUNCTIVITIS.

R. S., æt. 37, Jewess. Both eyes affected; duration, 2 months. The Morax-Axenfeld bacillus (see Fig. 16) was cultivated from the discharge on two occasions at the interval of one month. The fan-shaped areas of sodden skin at each canthus are characteristic.

in young and in old. There is no doubt the disease is more common in adults; the curve of age incidence in Fig. 15 shows this most clearly. There was no case recorded in the infant group.

As to the supposed greater incidence in women, the Moorfields statistics lend some support to this view. There were in men 16 cases in 1,307, or 12·15 per 1,000;

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in women 23 cases in 1,552, or 14·81 per 1,000. In the 17 cases investigated bacteriologically and seen at various hospitals, I find 12 women and 5 men.

Bacteriology.—Twenty-one bacteriological examinations were made, and in these cases the specific organism was found seventeen times. Eight of these cases were in young subjects under twenty years of age, and in each of these cases the bacillus was isolated. In the 230 pathological cases examined this organism was isolated 36 times ; of these cases, 26 were in females.

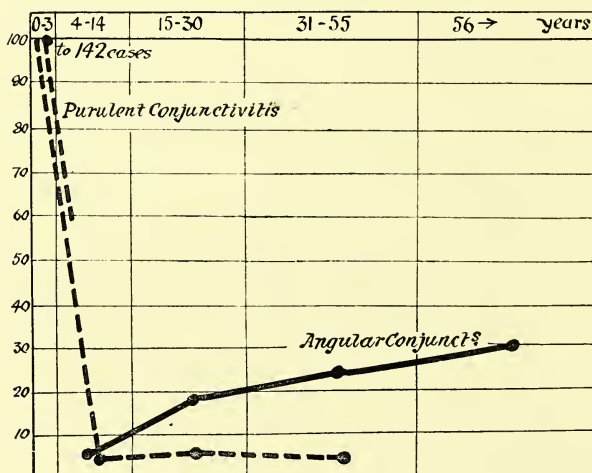


FIG. 15.—THE INCIDENCE OF 'ANGULAR' CONJUNCTIVITIS CONTRASTED WITH PURULENT CONJUNCTIVITIS.

To the former there is an increased liability with age, to the latter a diminished liability. (Moorfields Clinic, 1902.)

The organism is usually easy of demonstration. The thick, square-ended diplo-bacillus, staining well with the aniline colour, but decolourizing after Gram's treatment, is easily recognised (Fig. 16). The manner of growth of the organism on inspissated serum is characteristic: the serum is liquefied in deep, sharp-edged pools, at the bottom of

which is found a little turbid fluid, as a rule after forty-eight hours' growth. This turbid fluid consists of numerous bacilli, showing many involution forms, beaded chains of short bacilli almost of coccid form, longer bacilli in pairs, fours, or even in greater lengths, and some short, swollen forms three or four times the normal thickness (Fig. 17). It is a difficult organism to subculture either on serum or hæmoglobin media, but I have succeeded in obtaining growths, even initial growths, on ordinary agar slopes. The cultures die out quickly.

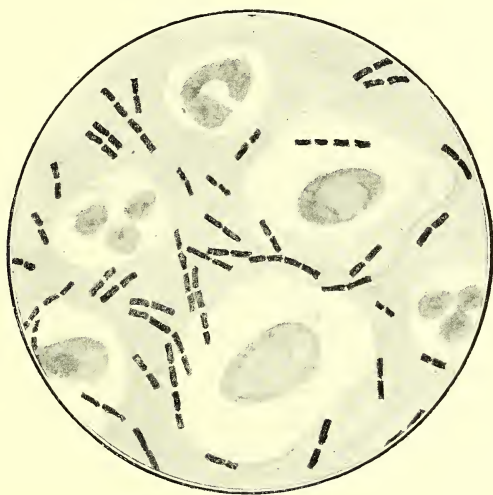


FIG. 16.—FILM PREPARATION OF THE SECRETION FROM THE CASE OF ANGULAR CONJUNCTIVITIS SHOWN IN FIG. 14, SHOWING THE MORAX-AXENFELD BACILLUS. ($\times 1,500$.)

As regards the specific pathogenicity of the organism, all attempts to obtain any reaction by inoculation in animals have failed. I have inoculated animals with both the fresh secretion and with rich cultures from severe cases; the material has been rubbed into both the sound and abraded conjunctiva of guinea-pigs, but no reaction has been produced.

Baird says the organism is never met with in the normal conjunctival sac, but is a constant inhabitant of the nasal fossa. Griffith found it nine times in 210 normal subjects. Amongst the 150 healthy-eyed school-children I examined, I obtained the organism four times: thrice in girls from the conjunctiva, once in a boy from the lid margin; and in these cases there was no evidence of present or past inflammation, and there was no sign of trouble when the children were examined a week

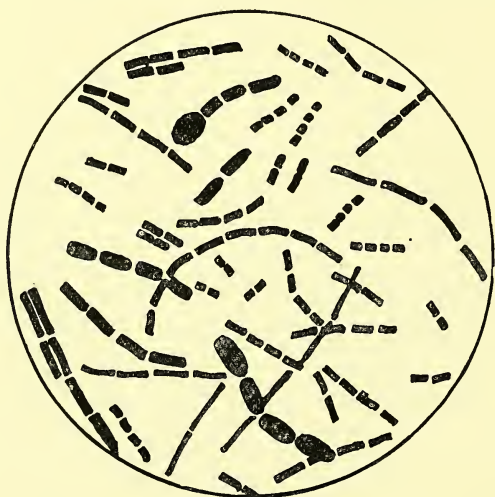


FIG. 17.—FILM PREPARATION FROM A CULTURE ON HORSE SERUM OF THE MORAX-AXENFELD BACILLUS OBTAINED FROM THE HEALTHY CONJUNCTIVAL SAC OF A SCHOOLGIRL, DIRTY GROUP. ($\times 1,500$)

The organism shows marked pleomorphism.

later. I do not think this occurrence in healthy eyes will invalidate the specific pathogenicity of the organism, any more than the demonstration of the presence of the virulent organisms of pneumonia or diphtheria in healthy throats can affect our opinion of their specific virulence. It will only show that, as with these latter organisms,

there must be some susceptibility in the soil before the growth of this particular bacillus can produce its specific effect.

MUCO-PURULENT CONJUNCTIVITIS.

Muco-purulent conjunctivitis is characterized by a marked degree of contagiousness. It frequently occurs in widespread epidemics; yet it is not uncommon even when there is no prevalent epidemic. If it appear in a household, all the members are very likely to be attacked, either simultaneously or in turn.

The subjective symptoms differ only in degree from those of ordinary conjunctivitis. Objectively, it is characterized by the constant presence of pale grayish-yellow pledgets of muco-pus in the lower fornix and lacus, by a marked hyperæmia of the whole conjunctiva, and by a tendency to a velvety condition of the upper tarsal conjunctiva, and by minute hæmorrhages about the loosely-supported vessels of the ocular conjunctiva. The lymph follicles normal to the lids are almost invariably swollen, and appear as slightly-raised pinkish-gray bodies about 0.5 to 1 millimetre in diameter. Commonly the attack begins in one eye only, and the severity of the symptoms may differ in the two eyes. Not infrequently the præ-auricular lymphatic gland is inflamed.

Not one of these symptoms taken alone, or even all of them together, are sufficient to constitute a definite clinical group of cases, save as an intermediate group betwixt the simple and the purulent catarrhs; but the investigations of Weeks into a large number of cases occurring in epidemics in New York have demonstrated the association of these cases with a specific micro-organism, first recognised by Koch in Egyptian ophthalmia (1883).

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The accuracy of Weeks' observations has been amply confirmed by the investigations of observers of several epidemics in widely-separated places. Morax, Stephenson, Guasparini, Gifford, Axenfeld, Peters, Fuchs, have all agreed in the constant presence of this organism under such conditions, and it is the presence of the organism which accounts for the contagiousness of this form of conjunctivitis.

The organism is a delicate rod, in film preparations,

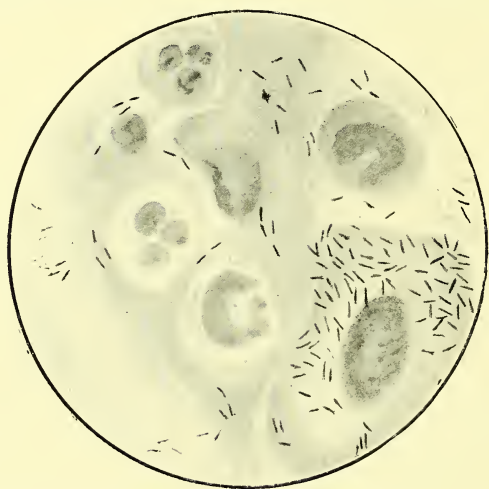


FIG. 18.—FILM PREPARATION OF DISCHARGE FROM A CASE OF MUCO-PURULENT CATARRH, SHOWING THE KOCH-WEEKS BACILLUS. ($\times 1,500$.)

The organisms are particularly numerous about the epithelial cells and cellular debris. In the left-hand quadrant are a group of bacilli showing a clear unstained waist.

measuring about 1.5μ in length, and about $\frac{1}{10}$ to $\frac{1}{12}$ its length in breadth. It is frequently slightly nipped in or unstained at the waist. It is not easy to cultivate; successful growths are proportionate to the severity of the inflammation of the membrane from which it is obtained. I find inspissated horse serum the best all-round medium,

particularly if a large quantity of the secretion is taken over on inoculation ; yet I have obtained growths on plain agar, for in almost every case I examined duplicate cultures were made on serum, agar, and sometimes other media. In many cases I have rubbed the free end of the platinum wire over a particularly inflamed patch of conjunctiva so as to draw a little blood. The addition of the blood seemed to foster cultivation.

The colonies are exactly like tiny dewdrops ; very rarely they are slightly opaque. The organism on cultivation tends to become longer, but it never forms chains. It stains lightly with methylene blue ; it is decolourized by Gram's method ; it is non-motile and non-sporing. The cultures rapidly die out.

That the association of this organism with the mucopurulent type of catarrh is one of cause and effect cannot be doubted. The severity of the attack can be shown to be proportional to the numerical incidence of the organism in both the film preparations of the secretion and in cultures. Morax inoculated himself with a pure culture, and obtained a characteristic inflammation. Numerous workers have inoculated the organism into the conjunctival fornices of animals, but without effect. I have repeated the inoculations with similar negative results. Griffiths records that on one occasion he obtained a slight reaction after inoculation into a rabbit's eye.

The disease occurs in all ages. My statistics show that it is more frequent in women than in men. Of the cases in the Moorfields clinic, there were so diagnosed in men 8 cases in 1,397, or 6·12 per 1,000 ; in women, 18 cases in 1,552, or 11·6 per 1,000. Of 27 cases diagnosed as mucopurulent catarrh at various hospitals, and which I investigated bacteriologically, in 12 cases the bacillus was found, and of these 8 were in women. Taking all

the 230 pathological cases investigated bacteriologically, the Koch-Weeks bacillus was found 35 times—18 times in females and 17 times in males.

In writing thus far in this section, I have taken it for granted that the diagnosis of muco-purulent catarrh was a synonym for the presence of the bacillus. In the twenty-seven cases so diagnosed and examined, the organism was found twelve times ; in the remaining cases, which from a clinical view were fully entitled to the appellation ‘muco-purulent,’ a variety of organisms were obtained : four times the Morax-Axenfeld bacillus, thrice diphtheroid bacilli with cocci, once a Klebs-Loeffler bacillus, once the *S. p. aureus*, once a yeast. In a family of five affected at one time the causal organism appeared to be a pseudo-gonococcus (the *Micrococcus urethræ* of Foulerton): it was isolated in three of the family. It therefore appears that, although the Koch-Weeks bacillus is the most constant cause of this chain of clinical symptoms, a similar or identical train may be produced by other organisms, particularly such a one as the pseudo-gonococcus.

In some few cases the presence of the Koch-Weeks bacillus has been coincident with so severe a purulent conjunctivitis as to simulate the characters of the inflammation due to the *M. gonorrhœæ*. The discharge is, however, rarely so thick as in the gonorrhœal form ; it inclines to a thin watery, almost sanious character, yet this same variety of discharge is found in undoubted gonorrhœal affections when seen at an early stage. The differential diagnosis can present no difficulty when the discharge is examined microscopically.

The bacillus was also found associated with the formation of a ‘pseudo-membrane’ on the conjunctiva ; its presence was common in the discharges in cases of



Angular Conjunctivitis

trachoma. These two points will be considered under their respective clinical headings.

In the severer cases of this muco-purulent conjunctivitis a peculiar form of ulcer occurs—a ‘catarrhal ulcer,’ characterized by its sharp edge, crescentic shape, and marginal position—features which distinguish it from the common traumatic ulcer, the more serious serpiginous ulcer, and the limbic ulcers of phlyctenulæ in children. Such an ulcer is particularly liable to occur when there are hæmorrhages about the limbus, or when there is œdema of sufficient degree to interfere with the circulation of the vascular loops of the limbus. The lymph circulation of the cornea is disturbed, the corneal nutrition is affected, the surface cells die, and are readily penetrated by the invading organism. The clear-cut margins which the ulcers present, especially towards the limbus, and the way in which they heal, suggest altered nutrition as an important factor in their causation. In England the elder folk seem more liable to these ulcers than the young; corneal lymph circulation is less satisfactory in the aged than in the young. In the East, owing to the greater intensity of the inflammatory reaction, ulceration appears to be exceedingly common and severe, and the resultant scars are sharply marked and dense.

The Affinities of the Morax-Axenfeld Bacillus and of the Koch-Weeks Bacillus.

The question arises, Whence come these specific organisms—the diplo-bacillus of Morax-Axenfeld and the bacillus of Koch-Weeks? We can hardly suppose they are peculiar to the conjunctiva, and affect it alone. Both of them, from the little we know of their life-history

and their characters under artificial cultivation, show they have a distinctly parasitic habit. They take on the saprophytic life of the laboratory culture media with difficulty ; they early show involution forms ; they are non-sporing ; their generations soon die out.

Baird writes of having found the Morax-Axenfeld bacillus constantly in the nose. Bienstock described certain bacilli of the intestines which have a peculiar faculty of liquefying solidified albumin, a feature also associated with this bacillus. The Koch-Weeks bacillus, in its morphology and reactions, is very like the bacillus of influenza, and particularly agrees with it in its epidemic characters. Rymowicz has made exhaustive comparative experiments in the idea that the organisms might be identical ; although he was unable to show that the specific effects of the two organisms were interchangeable according as they were inoculated into the body or on to the conjunctiva of the animal, yet their striking general similarity led him to conclude that they were identical organisms. Knapp, on the other hand, considers it is possible to distinguish these two organisms by their morphology alone. The Koch-Weeks bacillus is uncommonly like the bacillus of mouse septicæmia, and not greatly different from the *Bacillus coprogenes parvus*, isolated from alvine discharges by Bienstock, and which I found once in a healthy conjunctiva. I also found in healthy eye sacs, as well as in disease, the *B. coli*, and in disease the *B. pyogenes fætidus*. Twice in healthy eyes I obtained a bacillus answering to the ' drumstick bacillus ' isolated by Bienstock from fæces, and which I have named in my list *B. alvei*, following Eyre. The frequency of these alvine contaminations, and the features of both the bacilli of Weeks and of Morax, incline me to speculate on the possibility of both these organisms being intestinal

organisms, and their presence in the conjunctival sacs due to inoculation of the conjunctiva with alvine discharges. Such a contamination is only too easy of attainment in the class of folk who are almost exclusively the subjects of the affection ; also the particular liability of women to be the hosts of these organisms may be explained by the greater risk of soiling they run, for reasons referred to before (p. 45).

‘Parinaud’s Conjunctivitis.’

Parinaud, in 1889, described a form of conjunctivitis which he believed to be due to the transference of some infective agent from animals to man. Cases have been recorded by other observers in France and America. The recent paper of Verhoeff and Derby gives a summary of all cases published to date, with the exception of some published by Doyne, of Oxford.

The condition is described as being somewhat like ‘granular conjunctivitis’ in its early stages. There are ‘vegetations’ large and small, at first semi-transparent, later opaque or yellow, reaching sometimes to the size of the head of a large pin. They are situated on the conjunctiva of tarsus and globe, and particularly in the retro-tarsal folds. There are mucous secretion and fibrinous deposits. The lids are swollen and hard ; there are irregular nodules of infiltration. The præ-auricular gland is inflamed, and sometimes those in the neck. There is some febrile disturbance ; the adenitis may proceed to suppuration. The duration is apt to be long, and may extend to six months. No infective agent has been demonstrated to be associated with these cases, and the early idea that contact with animals was a predisposing cause has been discarded. In the cases reported it is

found that the sexes are equally affected at all ages. The affection is usually unilateral.

Such a series of symptoms as these should not seem difficult to verify in the large hospital practice to which London men are admitted, but I cannot say I have ever seen a case at all approaching this order, and which I could distinguish with any degree of confidence as being a definite clinical entity. I have notes of five cases of unilateral conjunctivitis conforming in some measure to the chain of symptoms described by Parinaud, and such that, had it not been for the character of the bacteriological examination, I might have been tempted to consider mysterious enough to warrant 'segregation'; but the organisms found decided me against such a course.

Of the five cases, in four the Koch-Weeks bacillus was found associated with staphylococci. In the fifth the conjunctiva swarmed with a bacillus proved to be of the colon variety, and associated with *Staphylococcus subflavus*.

So far, then, any cases I have seen at all corresponding to the kind believed by Parinaud and others to be a clinical entity have not appeared distinguishable from muco-purulent catarrh, produced by organisms known to be capable of producing such an inflammatory condition. But none of these cases have shown the severe features of necrosis of subconjunctival tissue, suppuration of the inflamed lymph-glands, and prolonged duration, referred to in the original descriptions, which almost suggest a tubercular affection.

CHAPTER XI

THE TREATMENT OF ALL ORDINARY FORMS OF CONJUNCTIVITIS

THERE are a host of collyria. All of these are of a very mild constitution, as solutions of drugs go. Powerful drugs are there in solution, but in most minute quantities. From boric acid to corrosive sublimate is a wide reach, and suggests an intervening gradation in strength of medication at once flexible and valuable ; but I am inclined to think that all of them, in the strength in which alone we can use them as collyria, are of equal efficiency as germicides.

Corrosive sublimate is considered one of the most, if not the most, powerful of germ killers. The action of this agent on the *Staphylococcus pyogenes aureus* has been investigated by several workers. Their results have differed according to the methods employed. Elaborate investigations have been made by Abbott, myself, and by Andrews. The cultures were exposed to the action of 1 in 1,000 solutions ; 1 c.c. of bouillon culture was added to 49 c.c. of the germicide, and constantly stirred, so that there was the closest possible contact of the microbe with the largest body of solution. Abbott showed that under these conditions staphylococci would survive five, ten, twenty, or even on occasions thirty minutes, and be capable of cultivation.

In my experiments growths were obtained after such treatment of the coccus for twenty minutes, whilst an allied coccus—that from the South African veld-sore—resisted destruction for forty minutes. Andrews similarly obtained growths of the staphylococcus after twenty-five minutes' exposure. The microscopical characters of the surviving organisms suggest that the resistance of the organism is due to the glæa thrown out by the coccus as a protection.

If this resistance obtains under conditions so unfavourable to the micro-organism, how can our comparatively weak and briefly-acting collyria slay the invaders of the conjunctiva? We cannot apply to this delicate membrane solutions of sublimate of 1 in 1,000, except under special circumstances, and even then the duration of the action of the agent is but short.

Yet there is no doubt these fluids have some action, for when even a weak solution of zinc sulphate, zinc chloride, sublimate, chinosol, or even boric acid, is instilled into the normal eye, there is temporary smarting, injection, and increase of tears. I have attempted to discover differences in the action (excluding for the moment any astringent properties) of many collyria, but have failed to prove with certainty any essential difference. Provided the lotion is introduced into the sac in any quantity, and its specific gravity is a little different to that of the blood, it will cause a reaction. The reaction appears to be proportional to the variation of the specific gravity.

This is a point which can be most effectively demonstrated on the nasal mucosa. If plain water be squirted into the nostrils it causes a violent coryza. It induces a profuse osmosis. If normal saline solution be used there is no reaction: the effect is rather pleasant than

otherwise. If a stronger saline solution be injected there is again an intense reaction.

These observations led me to try the effect of various substances on the eye, with the set purpose of causing an excess in the flow of tears. This result can be obtained by the instillation of pure water, any saline solution of different osmotic pressure to the blood, or hygroscopic substances other than salts.

Glycerine is one of this last order of reagents. If a small glass rod be dipped in the fluid, and the lower fornix of one eye be just touched therewith, there is smarting for the moment, and then the tears fall freely down the cheek. Even the other eye shares in the lachrymation. There is a slight increase noticeable in the size of the bloodvessels; the effects last about five minutes. I am inclined to think part of the merit attached by some to the use of protargol is due to the presence of glycerine in the solutions; the point is referred to later.

The essential oils also induce lachrymation. Two are especially efficient—allyl oil and benzyl chloride. I have used them dissolved in castor oil, the former in $\frac{1}{2}$ per cent. solution, the latter in $\frac{1}{4}$ per cent. solution. Both drugs have a slightly pungent but pleasant odour, and if smelled in the pure state on a warm day the tears flow and sneezing may be produced.

A single drop of these oily solutions produces effects similar to those of the glycerine, but of a more intense and prolonged character. There is rather more vascular dilatation. I do not propose these oils should be used therapeutically: they are too irritating. Indeed, I have recently used the allyl oil for its irritant effect in the treatment of the nebulous stages of interstitial keratitis with some benefit.

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Perhaps it is not possible to obtain a drug which should by selection stimulate the secretion of the lachrymal gland or of the mucosa ; the unity of the nerve-supply to glands, mucosa, and vessels may make such selection impossible.

Astringents.—There are some drugs which have this quality in even weak solutions. The popular remedy of a solution of zinc sulphate acts usefully in this way. A solution of copper sulphate of similar strength is more useful. Alum certainly has a most efficient action. The chief of astringents are the lead salts, but, alas! we dare not use them ; the risks of deposit in abraded corneæ are too great.

In most cases of simple catarrh the use of one of the astringent lotions, or, better, a weak solution of zinc chloride ($\frac{1}{8}$ per cent.), is sufficient, particularly if the patient is directed to drop the fluid into the eye with a proper pipette. Most patients seem to bathe the skin of the lids rather than the inflamed conjunctiva, unless specific directions are given.

If there be an inflammation which is suggestive of a definite bacterial infection, it is the duty of the surgeon himself to attend to its treatment in the first instance. The mucosa may be readily cleared of organisms, with little or no pain to the patient, by the admirable method introduced by Saint-Yves*—the application of solutions of silver nitrate. A 1, or if need be 2, per cent. solution gently swabbed over the whole of the conjunctiva of upper and lower sacs and into the recesses of the semi-lunar fold will abort almost all the milder forms of conjunctivitis due to the invasion of micro-organisms.

The silver salt solution is best applied with a small

* Saint-Yves, 'Nouveau Traité des Malades des Yeux,' Paris, 1722.

swab twisted on the end of a glass rod. This is to be preferred to a brush. The swab is clean every time ; there are no hairs to get loose (Fig. 19).

The use of silver solutions may be rendered more agreeable by the instillation of a drop of cocaine (2 per cent.) before the swabbing, and a subsequent wash of

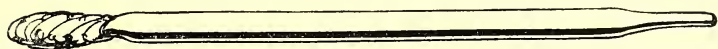


FIG. 19.—TAPER-ENDED GLASS ROD WITH COTTON-WOOL SWAB
TWISTED THEREON.

As used for applying watery solutions to the conjunctiva at Moorfields and elsewhere.

normal saline solution is comforting in that it removes the little rolls of epithelium cauterized by the solution.

Duration of Conjunctivitis.

The duration of treatment of conjunctival cases in children was examined in the Belgrave Hospital. The average attendance in weeks was : Simple catarrhs, 2·7 ; mild purulent and muco-purulent conjunctivitis, 3·25 ; ophthalmia neonatorum, 9·16 ; membranous conjunctivitis, 3·75.

CHAPTER XII

PURULENT CONJUNCTIVITIS

PURULENT CONJUNCTIVITIS is a disease which is responsible in these days for most of the preventable blindness. Of the blind children in the care of the London County Council, 38·6 per cent. owed their unhappy condition to this disease.

Its incidence falls with particular heaviness in the first few days of birth. The cases that occur in later years in civilized, and therefore more cleanly, countries are in a distinct minority. The curve of incidence in the Moorfields cases shows this most emphatically (Fig. 11); that of the Belgrave Hospital shows how heavy is the incidence of this disease in the first year of life, mainly in the first few weeks (Fig. 20); of 58 cases occurring in the first year of life, 44, or 76 per cent., were contracted at birth. Of the 101 cases amongst the blind children of the London County Council Schools, 94, or 93 per cent., were contracted at birth (these form 36·86 per cent. of the total number of blind, 255).

In all but a very few cases the affection is due to the inoculation of the conjunctiva with the *Micrococcus gonorrhææ* of Neisser, either directly or indirectly by discharges from the maternal genital passages. It appears that the severity of the conjunctivitis is pro-

portional to the recentness of the genital infection. Inoculation from a recently-acquired venereal disease commonly produces a much more intense conjunctivitis than does the inoculation with an organism which has remained latent for more or less numerous generations in the maternal passages. The researches of Piringer have demonstrated that the rapidity of onset and the

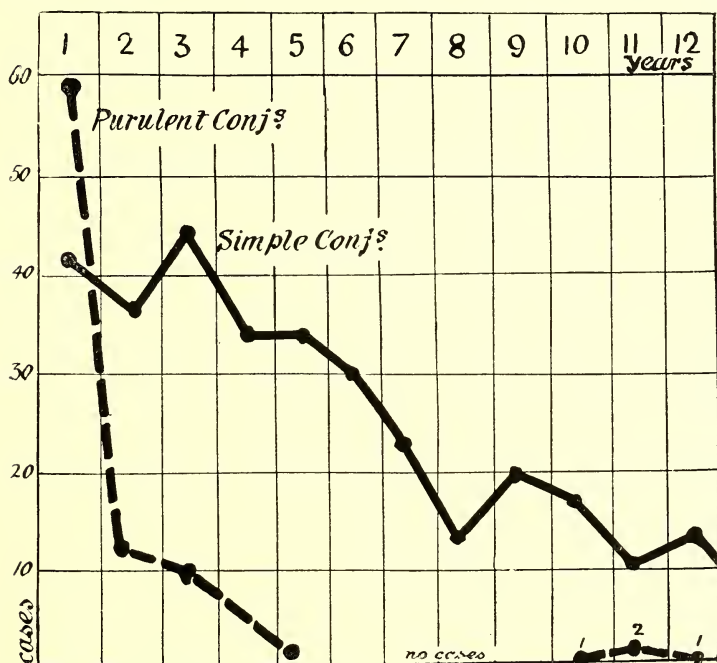


FIG. 20.—THE INCIDENCE OF PURULENT CONJUNCTIVITIS COMPARED WITH THAT OF SIMPLE CONJUNCTIVITIS.

The great majority of the purulent cases occur in the first year of life. (Belgrave Hospital for Children, 10 years.) (See also Fig. 11, p. 58, for chart of Moorfields Clinic.)

intensity of the inflammation are directly proportional to the freshness and concentration of the contagion introduced. The reaction was delayed and reduced by diluting or drying the contagion. Dilution with water to

100 times, or drying on linen for thirty-six hours, rendered it inert.

In the adult the contagion is nearly always conveyed by the fingers from urethra to eyes. There are cases, happily rare, of surgeon, nurse, or attendants being inoculated while attending patients; but the experiences of Vetch I have quoted in the historical section show how rare such cases need be with reasonable care, even in the midst of an epidemic of terrible severity.

There are instances, of no great infrequency, where the contagion is conveyed to the eyes by some filthy piece of quackery which recommends excreta as a fit collyrium. Such practices are fostered by a class of ignorant mystery-mongers to whom the schoolmaster seems to bring no illumination. Recently I learned of a means of propagating such diseases extant in China to-day of a kind well-nigh incredible. There is in Pekin a far-famed 'mule-god,' a large bronze figure sheltered in a gorgeous temple. The idol is credited with powers of miraculous healing. After the demands of the attendant priests have been satisfied, the votary approaches the mule, rubs his hand on the part of the mule corresponding to his diseased part, then on himself at the sore place. He repeats the alternate rubbings as long as he may. The medical missionary who told me of the thing said, to his certain knowledge, the mule's eyes had been rubbed out and repaired thrice during twenty years, but how many unlucky devotees had rubbed out their own eyes with filth passed from man to man by this means alone it was impossible to say.

Purulent Conjunctivitis in Adults.

It is convenient to take the cases in the adult first. The clinical picture these cases present is such that it is

impossible to mistake them. A rapid onset with much swelling, heat, pain, and redness of the lids, frequently of one eye only ; later, intense injection with profuse discharge, chemosis of the ocular conjunctiva by exudation from the vessels of so fibrinous a nature that it sometimes coagulates, making the swelling a stiff gelatinous mass, or else swelling up around the cornea until this is lost in the bulging folds.

Recently I saw two severe cases in men, one on the first day—the man knew what a gonorrhœal infection meant—the other of three days' standing. The conditions were typical.

First day case : Eyelids hard, 'feel like boards.' Upper lid swollen, glassy-looking, semi-translucent ; finer folds lost, grosser folds much exaggerated. Lashes clogged, tears coursing from each angle of eye. Conjunctiva bright brick red, rough surface, epithelium rolls off in strings ; each lymph-follicle is swollen : there are many in the lower lid fold and at angles of upper fold ; a few are scattered over the upper tarsus. The whole of the ocular conjunctiva is loose and ballooned up. The cornea is clear.

Third day case : Commenced by 'bad watering, sharp smarting, aching pain in the right eye, then through to the back of the head ; matter came on the morning of the second day.' There was profuse purulent discharge, fine gray membrane adherent to upper lid. Chemosis of ocular conjunctiva. Cornea was dull and hazy ; it ulcerated and perforated two days later. The skin of lids and face was purple hued and excoriated.

The injection of the palpebral conjunctiva in such cases is intense ; the membrane bleeds freely when touched. The papillary character of the upper tarsal surface is exaggerated to a degree that Vetch has likened to 'the valvulæ conniventes of the small gut injected with ver-

million.' Rarely the swelling of the lids may be so great that they become everted by the pressure of the chemosis.

The discharge is always profuse; at first thin and straw-coloured, or perhaps even markedly sanious; later in all cases it becomes thick and yellow from the enormous number of pus cells within it.

In many cases of the affection in the new-born, and almost always in later years, the præ-auricular gland is inflamed.

The danger to the cornea is great. It arises from two causes: First, the cornea is continually bathed in a pool of purulent fluid crowded with micro-organisms. The œdema about the limbus prevents its escape, so the organisms penetrate the interstices of the surface epithelium. Secondly—and herein lies the chief danger—the cornea depends for its nutrition on the state of the vascular loops of the limbus. In this chemosis, particularly in the firm fibrinous chemosis, the lymph-flow to and from the cornea is impeded or even blocked, so that there is a stasis of the circulating fluids in the substantia propria; also the nutrition of the surface epithelium is affected so that it becomes a ready prey to the abounding micro-organisms. The changes may, in slight cases, be only a general haze of the cornea, with later some ulceration in one or two marginal places. In the severer cases the ulcer may appear early at the margin near the region of the greatest chemosis. It may perforate speedily, or spread around the margin until a ring-like abscess is formed. In yet other cases the change is interstitial from the first. The gradually widening abscess breaks down in its centre, and the damage is severe. Cases have been described in which, as Fuchs puts it, the cornea seems to dissolve away like ice in the sun, and only a thin marginal rim is left of its structure.

In all cases where the cornea perforates the iris becomes involved in the opening, and permanently entangled. The growth of new tissue encouraged by the involved iris helps to fill the gap, and determines the future nature of the scar.

Not all cases exhibit these degrees of severity. Some may be so much milder as to differ little from a severe catarrh. There is, however, no difficulty in making an accurate diagnosis by the simple mode of the microscopic examination of a film preparation of the discharge.



FIG. 21.—FILM PREPARATION FROM A CASE OF OPTHALMIA NEONATORUM, SHOWING THE MICROCOCCUS OF NEISSER. ($\times 1,500$.)

It shows well the intracellular relation of the coccus to the leucocytes, and the intercellular relation to the squamous epithelium of the cornea ; the cement substance between the cells is crowded with cocci.

The bacteriological investigation of this disease is at once most simple and most difficult. The recognition of the organism in the film preparation is easily and rapidly performed (Fig. 21). The enormous numbers of biscuit-shaped cocci present, the characteristic way in which

they are crowded within the pus cells, even to as many as forty pair within a single leucocyte, and the decoloration of the coccus when treated by Gram's method, are for all clinical purposes true and sufficient evidence. The isolation of the organism is a matter of great difficulty, both by reason of the essential parasitism of the coccus, and on account of the presence of saprophytic cocci which early gain access to such eyes, and by their rapid growth on the nutrient medium obscure the special coccus. A method I have found at once convenient and simple is to make two cultures on agar. One tube is inoculated with secretion alone. For the inoculation of the second tube a patch of very vascular conjunctiva of the lid is gently mopped clean with sterile wool, and then rubbed with the platinum loop until blood flows; the tube is inoculated with the mixed blood and secretion. The first tube, inoculated with secretion alone, acts as a control. Early examination of the culture after from twelve to fourteen hours' incubation at blood heat, the discovery of minute, slightly opaque colonies on the blood smear, hardly recognisable without a lens, the presence of cocci which do not stain by Gram's method, and cannot be subcultured on to gelatine at a temperature of 22° C., together serve to determine the presence of a genuine *M. gonorrhææ*.

Occasionally the pseudo-gonococcus, or *M. urethræ* (Foulerton), was obtained either alone or in addition to the true coccus. The presence of this organism may cause a technical error in a diagnosis based on film preparations alone, but it is of no material importance to the treatment of the case. The error will be discovered if the bacteriological examination is carried to its proper end; then the pseudo-gonococcus will be distinguished by the readiness with which it takes on the

saprophytic life of culture media. I found this pseudogonococcus as the apparent causal agent in a series of cases of muco-purulent catarrh occurring in one family.

The position which the coccus assumes in the conjunctiva has to be noted ; it is important in considering treatment. Fig. 21 shows a flake of corneal epithelium found in a film preparation ; the cocci are seen to be crowded within the intracellular cement substance. The organism is intracellular as regards the pus cells, it is intercellular in relation to the surface epithelium ; it is this latter feature which accounts for the difficulty in ridding the mucous membrane of the parasite. In examining cases of ophthalmia of the new-born, I obtained on one occasion excellent cultures of the coccus, and at several times typical film preparations, despite the fact that the conjunctiva of each of these cases had been swabbed by good nurses on ten consecutive days with a 2 per cent. solution of silver nitrate. The solution was tested by the chemist and found good.

The *treatment* must be regulated by the stage of the inflammation, and the age and habit of the subject. In adults in an early stage, with an intense reaction, chemosis, and sanious discharge, we must try to get rid of the contagion, and yet avoid increasing the œdema and the attendant risk to the cornea. As a general régime, it is well to put the patient on slop diet, stop the use of alcohol, and give a brisk purge.

The sound eye should be protected by covering it with a Buller's shield. The shield should be sealed on with collodion. (Shields are not convenient for use in infants, but danger may be reduced by frequent and careful cleansing of the affected eye, and placing the child in such a position as will insure that discharges shall run to the temporal side of the affected eye.)

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The inflamed eye should be irrigated with a full but gentle stream of tepid boric or Condyl's fluid, so as to wash it as free as possible from infective material.

The earlier practice of syringing the eye has been rightly discarded ; it endangered both the patient and the attendants. But washing with a Schuster's drop-bottle (the 'undine' of Moorfields Hospital) of 100 c.c. capacity is perfectly safe to patient and attendant. The lotion flows as a limpid stream, and is not under pressure, so there is no danger of splash. By no possibility can a careless nurse project a forceful stream, and the shape of the bottle is such that there is no temptation to bring the blunt end of the spout between the lids.

After the wash a 2 per cent. solution of silver nitrate should be swabbed into the fornices and over the mucosa of the lids, once only in the morning of the day. After a momentary repetition of the irrigation an ice compress should be applied to the closed lids, and leeches, even to half a dozen or more, to the temples, or, failing these, an old-fashioned cupping to an ounce ; the bleeding greatly reduces the œdema. This treatment will be repeated as progress may indicate.

As soon as the œdema softens, the purulent secretion can be best reduced by the application of a 2 per cent. of the silver nitrate once a day, with intermittent irrigation with any simple lotion.

When the secretion is stopped, the thick velvet pile on the tarsal conjunctiva can be best diminished by the daily use of blue stone applied by lightly stroking the surface with a flat, knob-like surface of a prepared mass or rubbed-down crystal.

If there is any procedure which has impressed me more than another in the treatment of such cases, it is the benefit derivable from copious and gentle washing ; but

it is not easy, in that it takes much time and trouble, and requires attention on the part of the helpers. In South Africa I had half a dozen troopers with fresh attacks of gonorrhœa contracted at the port at which we lay. No 'direct' treatment was attempted, but their infected urethræ were washed from the bladder outwards by a free micturition, induced by copious bland drinks and simple diuretics. The men were under absolute control: they were not permitted to move from their bunks, and they made record recoveries. If this can be done in the case of a part which cannot be got at, how much more in the conjunctiva, to which we can get access?

Despite this advantage of accessibility, we do not always succeed in getting a complete recovery—that is, without damage to the cornea. If there be severe œdema the case is desperate: any satisfactory antiseptic application to the conjunctiva is at the same time irritating and liable to increase the œdema and diminish the corneal nutrition; nevertheless the conjunctival condition must be treated: the corneal is secondary to it. The membrane should be swabbed with silver solution, the gentle irrigation continued more frequently. The skin of the outer canthus should be divided if tension will be thereby relieved, and if more bleeding than results from this measure be required leeches may again be applied to the temple. Atropine in solution must be instilled into the sac. Under these desperate conditions some have not hesitated to freely scarify the conjunctiva, but it is bad practice; the subsequent granulation and scarring completely undo any temporary benefit that may be obtained. If perforation threatens, many consider it is better to anticipate by a section of the cornea. I have seen cases in which the result of this has been so satisfactory that my inclination is towards this anticipation.

Purulent Conjunctivitis in the New-born.

The condition differs only from the preceding in the intensity of the attack ; it is rarely of a violent type with much chemosis. There is the intense injection, the villous and bleeding conjunctiva of the lids—even tending to an extraverted condition during crying or violent respiratory movements—but the discharge is the profuse yellow fluid of the second stage of the disease in the adult. The risks to the cornea, however, are very nearly as great ; the condition of the poor little folk in the blind schools only too forcefully demonstrates this—the hugely bulged, hideous staphylomatous eyes, the shrunken forms of phthisis bulbi, and the small dense leucoma which has just spoiled the eye, all tell the same tale.

In the majority of cases in adults one eye is alone, or at first, affected. In the majority of infants both eyes are usually affected, yet there are cases in which the disease affects one eye only. In the infantile cases examined bacteriologically there were five unilateral cases ; in the records of the Belgrave Hospital I find another five. I was surprised to note that in all, except one, of these ten cases the left was the affected eye. The possibility of some connection with the earlier birth of the left eye, or its position in delivery, as might be produced by the relation of the very general left occipito-anterior head position to the usual lying-in position of British women, led me to put the question to an expert obstetrician. He said that in the common left occipito-anterior presentation the left eye would be for a longer time in the filth lodging on the bed and mother's thigh than would the right. If there is anything in this, Continental reports should show no difference in the frequency with which

right or left eyes are affected alone, for there women are delivered dorso-cubitus. I can find no records on the subject.

A point worthy of note is the risk which other members of a family run when there is a baby affected with the disease in the household. In November of 1903 I saw a family of mother and four children. The baby girl developed the disease on the third day after birth; a girl of four years contracted it on the eleventh day; another of eight on the seventeenth day; the eldest of ten on the twenty-third day. All were severely affected, and each had contracted a vulvitis. In all these cases the cause of the disease was demonstrated to be the *M. gonorrhææ*. On the twenty-fifth day, when the mother brought them to the hospital, she had smarting of the eyes and an access of tears, but no organism could be detected.

Treatment.—In the absence of the acutely irritable stage of chemosis, we are not handicapped in our use of antiseptics. The eyes or eye, after thorough cleansing by the same gentle stream of lotion from a drop-bottle as I have described, and never by the use of nozzles, squirts, or other elaborate contrivances, may be swabbed with the chosen antiseptic. This is in my judgment silver nitrate.

On the efficiency with which the early treatment is carried out depends the success of the case. Promiscuous swabbing with silver solutions without proper cleansing is almost as bad as the masterly inactivity of Master Rowley, whose record I have quoted, and his pride in the manner in which he physicked the mother for the ophthalmia of her new-born babe, whilst he left the babe to take care of itself! Carelessly swabbing a conjunctiva welling up with pus is but adding another irritant to the

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already unhappy eye ; no efficient solution ever gets to the conjunctiva : it is decomposed by the pus, and adds a myriad of minute foreign bodies to the stew.

I think that herein lies to some extent the secret of the merit that has been accorded by some to the use of protargol. This preparation is in most cases rubbed up with glycerine. Now, glycerine has marked hygroscopic properties. If you dip the nerve of a muscle-nerve preparation of a frog's gastrocnemius into glycerine, the water is abstracted so rapidly from the nerve as to produce a stimulus sufficient to throw the muscle into a tetanus. If glycerine be injected beneath the skin of the back of a mouse, the same abstraction of water from the dorsal nerves and spinal canal is so great that the stimulus throws the mouse into a violent tetanus, and it dies speedily. So the swabbing with the glycerine preparation causes an access of tears, the eye is washed, and the secretion diluted.

I have tried three ' colloidal ' preparations of silver—protargol, argyrol, collargol ; the last is not made up with glycerine. I cannot say I have been greatly impressed with them. They do contain active silver, but the point to my mind is : Are these costly preparations in any way superior to the cheaper, well-tried, and trustworthy solutions of silver nitrate ? I do not think they are in any way superior, neither do I think they are so good. I am certain of this : had I the misfortune to get a splash of pus from such a case into my eye—which is remote with the use of protecting glasses—I should choose silver nitrate for application, after washing, and not a colloidal preparation.

It has been claimed by some that these colloidal preparations have a specific bactericidal action, and that they have a special penetrative power. Credé (films) is so

strong on this specific action that he injects intravenously a solution of collargol in cases of puerperal fever. Brunner showed that the collargol only exerted a marked inhibitory action on the growth of bacteria, and did not destroy them. J. Bamberger found when the collargol was added to horses' serum silver particles were thrown down, and in the course of eight days the exposed tubes of serum were simply crowded with bacteria. He further found that on intravenous injection the collargol was precipitated, and there followed a marked leucocytosis, which was beneficial in the fever. His experiments tended to show that this was in part due to the colloidal properties of the preparation. If these colloidal preparations of silver are so readily precipitated, they can have very little penetrative power when applied to the conjunctiva; and however much leucocytosis may be of use in a general febrile condition, it can be of no service in the local inflammation: there is enough of it already.

Prophylaxis.—By a certain preventative régime the incidence of the disease in children born in public institutions has been greatly reduced. The method which Credé (père) first put into practice and adopted at the Leipsig Lying-in Asylum has been an undeniable success. In this institution the average incidence of 10·8 per cent. before the use of the method was reduced to 0·1 to 0·2 per cent. There are many similar examples of its success elsewhere.

The method is simplicity itself: As soon as the babe is born, the eyelids are washed and wiped clean, then a drop of the 2 per cent. silver nitrate solution is instilled between the lids of each eye. (Other solutions have been used, but the silver remains the best, because it has a selective action on the intercellular substance.) There is not the least difficulty in the procedure.

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I have never found mother or nurse make objection thereto.

It has been proposed that the method should be made compulsory by law. Recently the proposition was discussed by the Obstetrical Society, but no line of action was arrived at. Later there appeared in the *British Medical Journal* a strenuous protest from Sinclair. The objection was based on two grounds: (1) That the risk of the procedure outweighed its prospective advantages, seeing the incidence of such blindness was small. (2) That it was an unwarrantable stigma on the parents, and an interference with the liberty of the subject.

There is without doubt a good deal to be said for this view.

1. Of 22,000 children in the London County Council schools in Hackney whom I examined in 1903, only 5 children showed any traces of ophthalmia neonatorum. Again, the Council educates 550,000 children, and has only 94* children in its blind schools as a result of ophthalmia neonatorum. It would be more correct to say these 94 represent a collection from the whole school population of the class in London—*i.e.*, from 760,000 children; for, since the Council is compelled by law to provide for the blind, halt, and maimed, these cases are promptly passed over from any other elementary schools they may be taken to. Also the blind are kept at school until they are sixteen years of age, whilst a large proportion of normal children leave school at twelve, the rest at fourteen. These figures show that in Hackney only 0·02 per cent. of the children presented signs of probable ophthalmia neonatorum; whilst out of all the London

* Some of these children are cared for in London at the instance and cost of other County Councils; their presence will balance to some extent other London cases in private institutions.

elementary school-children those blinded from this cause reached only 0·014 per cent. The figures are small, but they represent an immense amount of disability and suffering.

Next, I made it my business to inquire of doctors who had large midwifery practices, particularly in factory districts. They said they did not use the method; they found no necessity for it. One doctor in large practice in such a district said when he first commenced work he used the method regularly, applying perchloride of mercury; he gave it up because he found it caused irritation; without it he had not had a case of inflammation. On inquiry, I found he had used 1:1,000 solution. This solution is too strong, and the instance illustrates the danger of the procedure when there is not sufficient knowledge.

2. There is also a reasonable objection on the ground of sentiment to any legal enforcement of the method of Credé. It is a disease, unlike small-pox, to which all unprotected, clean and dirty, moral and immoral, are liable; there is a stigma attached to it amongst those who discover its cause. The legal establishment of a prophylaxis would at once dispel any ignorance as to the nature of the contagion intended to be combated, and the vast majority would strenuously resist a measure proposed for the safety of the few to the branding of all: the measure would be inoperative, and not only so, the use of the method as at the present time would be stopped. To-day it depends only upon the tact and manner of the practitioner whether or no he is allowed to so treat the baby's eyes if he thinks fit. With a widespread knowledge, such as would follow attempts at legislation, he hardly could dare to do this. The doctor who tactfully uses the method amongst his patients does far more to

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spread the use of the precaution than any appeals for legislation will ; for the gossip of ignorance is as likely to put it in the position of an expected ' rite,' attendant on the solemnities of birth, as the ingenious mischievousness of old hags who practise the rite of ' dispelling the witches' milk.'

Is there, then, nothing to be done to check the disease ? It occurs in just those people who are most ignorant, most easily lulled into security by the wisdom of the old women, and least likely to spend the time and trouble attendant on a visit to hospital.

Stephenson has proposed notification—compulsory notification of all cases occurring. The idea, I think, is good. But what then ? The hospitals are overcrowded now. The proper treatment requires not only skilled attendants, but those who are skilled in the knowledge of this disease. There should not only be compulsory notification, but special arrangements for the reception of such infants into hospitals where there would be provision both of cots and of a special staff of attendants to look after these cases alone. The absolute control for one week of a child so infected is worth a month of outpatient attendance. Under such conditions blindness from this cause might be reduced to an inappreciable quantity.

Such a scheme, to be effective, must be very simple. The notification should be made by nurse, parent, or doctor. The authority must be easily accessible and local. In the poor districts, where most of the cases occur, he must be someone whom the mothers know well ; the local vaccinator would do well. He should be able without fuss to transfer the child, and if necessary the mother also, to a hospital specially provided with a staff for this treatment. Probably a single receiving-house

for a whole county would suffice. The costs of such a proceeding would be far less than the present costly training given to these poor children in special schools, without considering the loss to the community in the partial disability of the blind, or the loss to the blind themselves.

[Fuchs says in his textbook (p. 58): 'Children have been known to come into the world with a blennorrhœa already fully developed—in fact, with the cornea already destroyed.' Such a case has never come my way. Injuries to the cornea from difficult labour I have seen, but never what is implied by a 'blennorrhœa.' At one time I received numerous stillborn children from Manchester and London; in not one of these was there any sign of an inflammatory condition of the eyes.]

CHAPTER XIII

FALSE MEMBRANE OF OR ON THE CONJUNCTIVA

THE presence of a false membrane on the conjunctival surface indicates a severe and acute inflammation of that surface. The presence of such a membrane gives the name to the disease diphtheria. Most cases of diphtheria show a membrane at the site of infection, but every membrane on the conjunctiva is not 'diphtheritic.' The presence of a false membrane may be, but is not necessarily, diagnostic of diphtheria.

The term 'membrane,' or, more properly, 'pseudo-membrane,' is given to films of varying thickness which cover mucous membranes under certain circumstances. The 'membrane' can be produced artificially and instantly by swabbing the conjunctiva with a caustic, say a strong solution of silver nitrate; the caustic kills one or more layers of cells, which can be stripped off as a delicate pellicle of grayish colour, leaving the underlying surface redder than normal, both because it is covered by a thinner remaining layer of cells, and because it is irritated.

The thickness of the 'membrane,' the character of its constituents, and the changes in the underlying tissue, vary with the order and intensity of the cause of the inflammation. It follows, then, there may be every

gradation between the delicate membrane or pellicle produced by a too severe application of a silver solution and one the result of a virulent organism, and which involves not only the epithelial layer, but also the subepithelial layer—a variety which no one would hesitate, by sight only, to diagnose as true diphtheria. This is true. Every gradation can be found. The extremes of the series, however, are so widely sundered that until recently they were considered as separate entities, and, according to the state of knowledge then, it was justifiable to so separate them. It has now been definitely ascertained that some, at least, of the simpler cases are due to the same cause as produces the most severe; we accordingly have to determine whether we are still justified, for clinical purposes, in dividing the cases into two groups.

There is no doubt that the clinical conditions, as indicated in the local changes and in the general health, fairly warrant some such distinction. Accordingly, we have ‘croupous,’ ‘pseudo-membranous,’ ‘diphtheritic,’ and the like. Such distinguishing terms, however applied, are objectionable, in that to-day they imply some belief as to the cause of the condition. The difficulty involved has been long recognised by physicians, and a better terminology, based on the intensity of the necrotic process, whether it remained superficial to or penetrated below the basement membrane on which the epithelium rests, has been advocated. Payne (‘Textbook of Pathology,’ p. 456) suggested ‘diphtheritis superficialis,’ and ‘diphtheritis profunda.’ But the use of any derivative of *διφθέρα* in any other sense than indicating a causal connection with the Klebs-Loeffler bacillus is now impossible. A term which would cover the whole series of these cases, provide a convenient distinction between the extremes based on the severity of the clinical appearances of the

lesion, and yet not commit to any definite etiology, would be of great value. It would serve to distinguish certain symptoms the cause of which would be ascertained in the clinical laboratory.

A couple of years ago two papers were read on the same evening before the Ophthalmological Society on the subject of this disease. Stephenson maintained that all cases were due to one specific organism, so retained the term 'diphtheria,' qualifying it as mild, moderate, and severe: granting his premises, the position taken up would be strong. Jessop, on the contrary, maintained that all cases were not due to the same specific organism, objected strongly to the term 'diphtheritic,' and suggested as a suitably comprehensive term 'membranous conjunctivitis' or 'membranous ophthalmia.' But these terms have been objected to on the ground that the word 'membrane' has already gained an accepted connotation with the Klebs-Loeffler bacillus. If this objection be maintained, I would venture to suggest that a convenient non-committing name could be found in

'Conjunctivitis Necrotica.'

It indicates only that the conjunctiva is inflamed, and that the inflammatory process has produced necrosis of the tissue. The extremes of the series could be indicated, as in Payne's nomenclature, by the addition of the qualifications '**profunda**' or '**superficialis**,' as the necrosis does or does not penetrate the basement membrane. The cause of the condition being ascertained, it would be added to the diagnosis in due course.

Of three cases seen, two might appear as 'Conjunctivitis necrotica superficialis,' whilst a third might be diagnosed 'Conjunctivitis necrotica profunda.'

At a later date Case 1 might be ascertained to be due to an invasion of pyogenic organisms only, 2 and 3 to the Klebs-Loeffler bacillus, pathogenic to animals. The information would be added to the diagnosis, thus :

1. Conj. necrotica supf. (*S. p. alb. and aureus*).
2. Conj. necrotica supf. (*Klebs-Loeffler bac., pathogenic*).
3. Conj. necrotica profund. (*Klebs-Loeffler bac., pathogenic*).

In this paper I shall, for clinical reasons, consider the cases in two groups, a 'profunda' class and a 'superficialis' class.

'Conjunctivitis Necrotica Profunda.'

It is convenient to consider this group first. I have investigated bacteriologically six such cases in children and one in a domestic cat. Among the 3,000 cases in the Moorfields clinic in 1902, only one such case is noted to have occurred. In another of the four bi-weekly clinics working on the same days I saw one other case in that year. In both these instances the rarity of the disease was shown by the interest exhibited by all the workers on duty at the time. These six cases, as distinguished from the 'superficialis' group, are the only cases of the kind that have come under my notice during three years either at Moorfields, the Middlesex, or at the Belgrave hospitals. On the Continent this type of disease would appear to be more frequent, to judge by the number of cases reported; but all English writers agree in its rarity in the United Kingdom.

Although there were differences in these seven cases, yet the leading characters were the same: An occurrence in very young children of poor parents; the obviously serious nature of the general symptoms—prostration and altered

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temperature; an affection of one eye only in all except one case (and that was not due to the diphtheria bacillus); the great swelling of the lids, with marked excoriation and necrosis of the skin, to so severe an extent in one case as to present the clinical picture of 'noma' (Fig. 22); the palpebral fissure sealed with a tenacious yellowish deposit; the palpebral conjunctiva, when it could be seen, covered by a thick shining gray membrane, removable with difficulty, and only in small pieces; an underlying surface of a dirty grayish red, unhealthy appearance;



FIG. 22.—THE EFFECTS OF THE INVASION OF THE KLEBS-LOEFFLER BACILLUS.

J.A., ♂ æt. 3 years. 'Fell and cut outer canthus 3 weeks before.' Duration 1 week. Severe 'noma' of skin, intense congestion and bulging of lids; the conjunctiva pouts betwixt the lids, and is purple-hued. Death 4 days later.

ocular conjunctiva deeply injected with, in one case, such extreme œdema that it bulged out the lids, and absolutely prevented examination of the cornea; corneæ presenting varying degrees of marginal keratitis; a discharge of thin serous character, and rapidly coagulating on the lids.

One child, which had severe noma (Fig. 22) about the affected eye, died early; the others recovered. In one (Fig. 23) the eye suffered damage from corneal nebulæ and some deeply punched-out scars of the upper lid; in another the cornea was perforated; in yet another both eyes were badly damaged—one had to be excised.

The domestic cat, which was the subject of the disease, was a hospital pet, and lived in the out-patient department; it was very big and fat—weighing about 20 pounds.



FIG. 23.—THE EFFECTS OF THE INVASION OF THE KLEBS-LOEFFLER BACILLUS.

B.A., ♀ æt. 2 years. Duration 6 days. Necrosis of skin; coagulated discharge seals the lids and is encrusted below inner canthus; ocular conjunctiva purplish-gray colour beneath necrotic 'membrane'; marginal keratitis. Recovery with small corneal nebulæ and pitted scars of upper tarsal conjunctiva.

One eye only was attacked; the attack commenced in the nose, from which issued a profuse discharge for some days before the eye became affected. The animal was very ill, lost weight rapidly, and died. The discharge from the eye was at first thin, then thick and almost

gelatinous. A quantity of thick gray adherent material lay in the depths of the fornices.

The conditions in the children and the cat were such that there was a clinical diagnosis of 'diphtheria,' and by that was intended a disease due to the invasion of a virulent type of the Klebs-Loeffler bacillus.

In all cases except one the bacteriological investigation established the presence of a virulent bacillus. In the remaining case, in a two-year-old child of miserable habit, there was an intense inflammation of each eye, with a thick necrotic membrane, much chemosis and discharge and besides there were forty impetiginous ulcers, some large and deep, others shallow, scattered over head and body. The temperature ran a high course for ten days. In this case the investigation by the bacteriologist of the Middlesex Hospital showed that no diphtherial organisms were present; there was a pure culture of *Streptococcus brevis*.

The invasion of the Klebs-Loeffler bacillus, to which the disease in most of the children and the cat was due, constitutes one of the most serious menaces to the well-being of the subject which can arise in an inflammation of the superficies of the eye. Not only is the integrity of the eye threatened, but the life of the subject is endangered. Other inflammations—that due to the gonococcus, to the Koch-Weeks bacillus, to the pneumococcus, or to the condition of trachoma—endanger the vision, but there is little or no danger to the life of the subject.

The difference arises out of a peculiar virulence possessed by the Klebs-Loeffler bacillus. The organism exerts a powerful irritant action locally, which endangers the eye just as do those other organisms, but the influence of the others stops here. Not so with the Klebs-Loeffler bacillus: the local activity of the organism is coincident

with the generation of a powerful poison, which is absorbed into and diffused throughout the whole body. The knowledge we have of the life-history and activity of micro-organisms shows that the production of complex chemical bodies is common to all. Some of these bodies are antagonistic, others, under normal circumstances, probably useful, to the host ; again, others, so far as we can ascertain, are indifferent whilst the host is in normal health. It is noteworthy of pathogenic organisms that the most swift and deadly effects are produced by those which have but a local habitat in the body, and in this limited field of action generate a poison which can destroy the host with startling rapidity. The virulent Klebs-Loeffler bacillus is typical of this group.

The histology of the 'pseudo-membrane' has often been demonstrated in faucial diphtheria. I was able to demonstrate it in a fashion in film preparations of fragments removed. There was seen a felted mat of necrosed cells in a coagulum of exudation, or, as I described it in my notebook, there was 'a tangle of sodden swollen epithelial and pus cells in an equally sodden coagulum.' These features are the indication of the intensity of the inflammation. The affected tissue is destroyed ; at the same time the inflammatory exudate is so rich in fibrin that in flowing out it is coagulated, and more or less binds the destroyed surface to its base ; hence the toughness and the tenacity of these false membranes. They are in marked contrast to the more delicate pellicles found in the 'superficialis' group ; these latter are removed with ease, leave a clean, brightly injected surface, and on recovery leave no scars.

Treatment.—Local and general treatment is necessary for the destruction of the organism in its local seat and the counteraction of its general toxic influence on the body.

Happily, local treatment is comparatively easily affected : we can get at the eye, and safely and frequently apply efficient yet not destructive antiseptics. The solutions of silver nitrate are undoubtedly the best preparations. Whatever may be the ultimate issue of the competition of the several colloidal preparations of metallic silver in the treatment of the ophthalmia of the newborn, I doubt if in these cases the nitrate will be supplanted. In the successfully treated cases a 2 per cent. solution was applied with small swabs to all the conjunctiva that could be reached, and with each application the conjunctiva could better be reached. I do not think it necessary to attempt the removal of the membrane ; it is difficult, and the conjunctiva is so rotten that it is easily injured. It appears better to wipe away the upper softer layers before each application ; the solution will penetrate to the deeper layers where the organisms lie.

Tweedy has strongly urged the utility of quinine (0.75 to 1 per cent. solution) in the ' profunda ' cases, both as a wash to the conjunctiva and a continuous compress to the lids. Recently he did me the honour of demonstrating the results of this treatment by a reference to some fifty private patients seen during many years. The excellence of the results obtained was most impressive.

As regards the treatment of the general symptoms, the aim is to combat the toxin either directly by an antidote, or indirectly by neutralizing its depressant action. The researches of Behring have found the former, and of its utility there is no doubt ; it has been amply demonstrated in the graver diphtheria of the throat. For its complete success the antitoxin must be used early in the course of the disease. In the case where

death ensued it was too late—the disease had advanced too far, as the severe necrosis of the skin indicated. In two cases which recovered no antitoxin was used, since the condition had improved on obtaining bacteriological results ; in another the disorder was proved to be unconnected with the Klebs-Loeffler bacillus.

On certain counts we are less dependent on the aid of the antitoxin in the disease of the eye than is the physician in the treatment of the affections of the throat. We can effectually get at the seat of the organism, the physician cannot. We can destroy the organism by local applications, the physician cannot. We can stop the production of the antitoxin, the physician cannot. Therefore on all counts the physician is more dependent on the antitoxin. Not that I discount for a moment the utility of the serum ; I would rather accentuate our advantage in attacking the seat of the mischief directly.

‘Conjunctivitis Necrotica Superficialis.’

These cases are more frequently met with than the ‘profunda’ class. Still, they are not common.

I have already referred to the variant opinions on the causes which may induce this less serious inflammatory reaction ; most hold the ‘membrane’ is not a specific character due to any one organism.

In 1903 I met with eleven cases where a ‘membrane’ was definitely present. The bacteriological conditions were worked out in each case.

There were found—Klebs-Loeffler bacillus in six cases ; Klebs-Loeffler bacillus with pneumococcus in one case ; Koch-Weeks bacillus in two cases ; *S. p. aureus* in one case ; *M. gonorrhææ* in one case.

Of the six cases in which a diphtheroid organism

occurred, pathogenesis was demonstrated in two ; in two others the organism was shown to be non-virulent to animals ; in the remaining two, in one a diphtheroid bacillus was found in a membranous condition on old scarred lids from trachoma, with much irritation, due to entropion, and in the other the bacillus occurred in a child with a pneumococcal conjunctivitis.

How we are to regard the cases in which a non-virulent organism was found is a difficulty ; perhaps an answer may be found in the variations in the pathogenic cases. In one case the inoculated guinea-pig was distinctly ill for two days—there was swelling and tenderness at the site of inoculation—then the animal recovered. In the other case the animal showed exactly similar symptoms in the first twenty-four hours, but by forty-eight hours it was dead. It is not just to base any conclusion on so few cases, but it is clear that in these two the organisms were either of unequal virulence, or the animals were unequally susceptible. It is not impossible, however, that the organisms, which were non-pathogenic to animals, may yet have been the determining cause of the local inflammation of the eye. The cases due to the Koch-Weeks bacillus come under this same category ; the organism is innocuous to the conjunctiva of animals, but it produces most inconvenient effects on the conjunctiva of men.

It would seem that the view we should take of the ‘*superficialis*’ cases is somewhat of this kind :

A membranous condition indicates a severe inflammation. It is frequently due to the Klebs-Loeffler bacillus, which may or may not be of such a virulence as shall enable it to exercise general maleficent influences. Are there any signs of such influences ? The bearing of the child, the temperature, the condition of the urine, will show. The bearing of the child I put foremost—there is no

better indication of its condition ; if it be fairly happy and cheerful, general influences may be discounted at once. A subnormal, or above normal, temperature or the presence of albumin in the urine would be signs of warning.

In these cases I have noted there were no symptoms of sufficient gravity to indicate the use of antitoxin, so it was not used. Local treatment with silver nitrate solutions was followed with perfect results in each case. I kept in touch with most of the cases for a couple of months, with some for a longer time ; during this period there were no symptoms of any paresis or other indication of a toxic influence.

Stephenson in his paper, and in the subsequent discussion thereon, urged as a weighty argument the fact that his cases of ' diphtheria ' of the eye, the majority of a mild type, had occurred during the months of April, May, and June—the period, he said, in which faucial diphtheria was most prevalent. A reference to my statistics of seasonal incidence of conjunctivitis will show how fallacious this argument is. All forms of conjunctivitis are much more prevalent, especially in children, at this season. The data obtained from the examination of the cases at the Moorfields and Belgrave Hospitals are most emphatic in demonstrating this (see Figs. 7 and 8, pp. 28, 29).

Necrotic Patches on the Conjunctiva.

Rarely cases occur of local necrosis or sloughing of the conjunctiva. I investigated one such case in a young child. The youngster was quite merry at the hospital ; there could be no thought of any serious constitutional reaction. Film preparations showed the sloughs to be crowded with streptococci. Inoculations demonstrated the presence of both the long and the short varieties ;

the latter were the more numerous. Recovery was speedy after the use of silver nitrate solution ; the application was only needed once. Small shallow scars remained for some time after the disappearance of the inflammation.

Diphtheroid Organisms.

Some reference must be made to the forms of these organisms met with in the conjunctival sac. They are perhaps the organisms most frequently met with in the



FIG. 24.—TYPES OF DIPHTHEROID ORGANISMS, DRAWN FROM FILM PREPARATIONS OF CULTURES. ($\times 1,500$.)

- a.* Short nip-waisted form. *b.* Short segmented form. *c.* Long form. *c'*. Long form with segmentation and clubbing ; some clubs are rounded, others pointed. Below *c'* are a pair drawn on a higher scale. *d.* Double clubbed form ; not at all uncommon. *e.* Very long form with marked segmentation almost simulating cocci.

sac ; certainly they far exceed in the normal state even the ubiquitous coccus. There appears to be hardly any part of the body, either in health or disease, in which the organism of one type or another has not been found.

The researches of Ford Robinson, referred to in the section on xerosis, show how frequent is the incidence in conditions of general paralysis. At a recent meeting of the Pathological Society of London, Victor Bonney described the discovery of an organism of this group in the uterus in puerperal fever ; the subsequently narrated experiences of other workers showed how widespread is the organism.

Various classes with more or less distinctive features have been suggested. The almost limitless gradations found show that such classing by hard-and-fast divisions is not possible by morphological means. When I started work on the bacteriology of the eye, I worked out a dozen cases without previous reference to the work of others ; there were readily isolated many varieties of the organism which I laboriously attempted to differentiate. For laboratory and mnemonic purposes I labelled them thus :

FORMS.

- Regular, nip-waisted.
- Short, with 'zebra marking.'*
- Medium, with zebra marking.
- Long, with zebra marking.
- With or without clubbing.
- With or without marked segmentation.
- With or without Neisser's reaction.
- Pathogenic or non-pathogenic.

This classification I found corresponded with the five types of Cobbett :

1. Oval bacillus with an unstained septum—young forms.
2. Long, faintly stained, irregularly beaded.
3. Regularly beaded—streptococcal forms.
4. Segmented bacilli.
5. Uniformly unstained bacilli.

* In the irregular, broken form of the bacillus, the marking is across the length of the rod, like the striping on the leg of a zebra ; hence the use of the mnemonic.

Laboratory classifications such as these are of little significance in clinical work. The classification of Park and Beebe is the best for these purposes :

1. The virulent diphtheria bacillus of Klebs-Loeffler.
2. The non-virulent diphtheria bacillus of Klebs-Loeffler.
3. The Hoffmann-Loeffler bacillus (xerosis bacillus).

These groups are distinguished by certain tests :
(1) The appearance of the colonies on serum cultures, and by the character of the organism under the microscope.
(2) Their reaction to Neisser's staining method. (3) Acid-producing properties. (4) Pathogenicity.

Neisser's reaction will separate out many of the non-virulent organisms, but it is not absolutely reliable ; Neisser recognised this himself. A rapid production of acid is an indication towards pathogenicity, but no test is absolutely reliable except that of inoculation into animals.

This can well be shown by contrasting two cases of my ' superficialis ' group occurring in anophthalmia—one of congenital, the other of surgical origin (see table, p. 133).

The cases were seen on the same day. The cultures were made at the same time, on serum tubes of the same batch ; incubation was simultaneous ; inoculations into animals of similar size, shape, and colour, from the same litter, were made at the same time ; and the staining of the films was synchronous. The tests were, therefore, as closely alike as possible.

Until the last test the organism from the baby looked more like being of the pathogenic order than that from the boy. The final test showed the inferences suggested by the reactions to Neisser's test were not true.

What the essential connections and differences of

the group are we do not know as yet. Hewlett and Knight have published work showing that the Hoffmann bacillus may be converted by cultural methods into the virulent organism. Richmond and Salter have obtained similar results by inoculation into susceptible birds. Conversely, Hewlett and Knight have reduced the viru-

	Baby, Five Weeks old.	Boy, aged Four Years.
State of conjunctiva	Profuse discharge fourteen days; now gelatinous film	Discharge ichorus, fine membrane, conjunctiva bleeds
Constitutional reaction	Marasmus	None
Treatment	Local, slow recovery	Local, quick recovery
Cultures	Pure Klebs-Loeffler bacillus	Pure Klebs-Loeffler bacillus
Organism	Pleomorphic, long form	Same
Acid production	Rapid	Rapid
Potato	No visible growth	No visible growth
Neisser's stain	Perfect polychromatic reaction	None
Pathogenicity	Guinea-pig not affected	Guinea-pig very ill twenty-four hours; dead in forty-eight hours

lence of the Klebs-Loeffler bacillus to the non-virulent Hoffmann type by inoculation at high temperature—45° C.

Other workers reject the conclusions, saying that in every inoculation there are many types of the organism, some virulent, others non-virulent, and that one or other type may survive and become paramount as the conditions of cultivation are varied.

CHAPTER XIV

TUBERCULOSIS OF THE CONJUNCTIVA

A RARE condition, most frequently associated with lupus of the skin of the face. Cases have been described which have arisen primarily—that is, when no tubercle could be discovered in other parts of the body. Such primary infections are believed to be due to local inoculation at the site of some injury from a foreign body (Valude).

Three cases only have come under my observation—one recent, another chronic, a third after recovery; the last only was unassociated with lupus. All three cases were in women.

The acute case occurred in a girl of fifteen years (Fig. 25). The face had been affected by lupus for seven or eight years; the glands in face and neck were enlarged. One eye only was attacked; there were three separate lesions. In the depth of each cul-de-sac were granulations studded with miliary tubercles; on the sclero-corneal margin was a patch of velvety granulations. The neighbouring cornea was gray and rough, almost in a condition of pannus; the iris was slightly discoloured; $V. = \frac{6}{18}$; tension normal; fundus normal. These conditions are typical of the disease. In this case the granulations were removed with a sharp spoon; they were rotten, and came away like a soft fungoid growth on dead wood.

Sections demonstrated the presence of giant-celled formations and acid-fast bacilli.

The distinctness of the lesions of palpebral and ocular conjunctiva call for remark. They were so placed that all three could not be in contact at any time ; the ocular and upper conjunctivæ would coincide when the globe was upturned in sleep, the ocular and lower conjunctivæ when the globe was strongly depressed. Could infection from one to the other take place under these conditions, or is it not more reasonable to suppose that there was

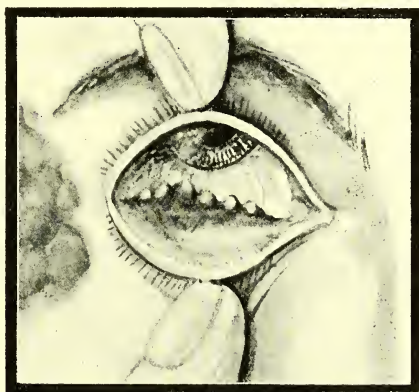


FIG. 25.—MILIARY TUBERCULOSIS OF THE CONJUNCTIVA (♀, ÆT. 15).

Lupus of face and enlarged glands, eight years' duration. Eye recently attacked. There is a bunch of similar tubercles on the upper retrotarsal fold. The outer quadrant of the corneal is rough and gray ; there are velvety granulations on the ocular conjunctiva.

more than one infection from the lupus through the bloodvessels, which are linked so freely in the supply of these regions ?

The chronic case occurred in a subject of the most shocking facial lupus I have seen (Fig. 1, p. 13). A woman, aged thirty-six, had suffered from lupus since childhood. There was left not a vestige of normal skin on

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face or neck ; the right conjunctiva was attacked after the whole of the lids had been eaten away ; the eye ulcerated, and had to be removed. The lids of the left eye were completely gone ; the globe was exposed for its anterior third ; the cornea was opaque. Despite the terrible condition of affairs, the woman could at all times distinguish moving objects, and on some 'good days,' for her, distinguish big objects.

The third case was seen in a healed condition. The history was not indubitable, but it appeared to have been a tubercular affection arising from some accidental lesion ten years previously. There was severe scarring of the sclero-corneal tissue, with great reduction of the corneal area, and the remains of iritis in adhesions and uveal pigment on the lens capsule. The general health of the girl had been good after recovery from the local disease.

Recently Stephenson published notes of a case of acute tubercular infection of the conjunctiva in which he had obtained a cure with the use of the X-rays. The utility of the rays in lupus would lead to hopeful expectations in such cases ; still, I think the risk of spread of the infection in such soft, moist vascular membranes connected with so many mucous channels, glands, and other regions, is so serious that we ought not to wait the action of the rays, but remove surgically any obvious tubercular granulations such as existed in the first case I have noted. Subsequently an insufflation of very small quantities of iodoform into the cul-de-sac is desirable until the raw surfaces show signs of healing. If, then, the surgeon desires to utilize the X-rays, well and good ; the obviously affected tissue has been removed. In most instances where cases have been recorded the authors have insisted on the thoroughness of the removal by scraping (Jessop,

Holmes Spicer). Even in lupus of the skin dermatologists are agreed that it is better to excise the area freely, provided *cosmétique* considerations do not prohibit.

An attempt has been made by Sattler to classify cases of this order into groups: as the conjunctiva is affected in a miliary form or in a papillary form; a variety in which the lids are particularly affected; cases associated with a lupoid condition. But, as Greeff remarks, there appears no good ground for making the distinction; the condition is the same. The distinctions appear to arise rather from the length of duration of the disease at the time of observation than otherwise. The first case I have noted looked very different from the second case—the one was comparatively new, the other very prolonged. In the first case all of Sattler's groups were illustrated.

CHAPTER XV

THE LYMPH FOLLICLES OF THE CONJUNCTIVA

SCATTERED over many parts of the conjunctiva, immediately beneath the epithelial covering, are numerous minute collections of lymph cells. Their distribution varies. They are fairly plentiful in the lower lid, in large numbers in the retrotarsal folds, very sparsely scattered in the conjunctiva, which is so firmly attached to the tarsal plate of the upper lid, but are fairly numerous at the angles of this lid ; they are absent over the ocular conjunctiva.

In structure they do not differ from the many other solitary follicles scattered throughout the mucous membranes of the body ; in fact, the discoverer of them likened them to the Peyer's patches about which he was writing—' identical structures existing in the under eyelid of the ox ' (Brush).* There is a supporting network of endothelial tissue made up of cells with fairly large oval nuclei, and many branching protoplasmic processes by which cell holds to cell ; along these processes there are occasional strands of connective tissue, the secretion of the cell. Packed within this sponge of tissue are innumerable lymph cells ; they are developed in these follicles, and the arrangement of the cells within

* Quoted in Gray's ' Anatomy.'



The Lymph Follicles of the Conjunctiva

the follicle is the direct result of this generation. In the centre of the follicle the cells are irregularly distributed and rather loosely arranged; the nuclei of some exhibit mitotic figures, indicating rapid cell multiplication. Towards the periphery of the follicle the cells are closer together, there is no sign of mitosis, the cells probably mature in this zone. At the periphery the lymph cells are arranged in fairly regular rows some half-dozen or more deep; they are closely packed, stain well, and mark out a most distinct zone of nuclei. The cells appear to wait in this outer zone until they are wafted off in the sluggish lymph circulation of the connective-tissue spaces, or are drawn to some spot of inflammation by irresistible chemiotaxis.

It seems likely that even under normal conditions of healthy conjunctivæ some few lymph cells pass through the epithelial layers into the free conjunctival fornices; they are found in the secretion of healthy eyes; they are occasionally seen in between the epithelial cells in sections from healthy eyes; and the passage of leucocytes from similar solitary follicles and the agminated lymph glands of the gut has been demonstrated more than once.

It is necessary to ascertain how far these follicles may be seen in the living subject under apparently normal conditions. So as to obtain some data on this important point, I made a systematic examination of over 1,000 children in a London County Council school, noting at the same time the condition of the conjunctiva, the visual acuity of each and both eyes, and also in the girls the condition of the hair of the head.

The school chosen was situated in De Beauvoir's Town, and receives its pupils from that district. The town is a model of what an urban dwelling-place should be. There are gardens both in the front and the rear of the houses;

the greater number of the houses are one-storied (ground and first floor) and semi-detached in plan. The man who laid out this estate must have acted with a thought and motive uncommon to estate owners in those regions. If one passes from the crowded area of Hoxton into this 'town' the contrast is very pleasing. The parents of the children are working folk; there is evidence that they know something of the virtues of thrift, for the children's savings-bank at the school flourishes; the majority of the children are well and cleanly clothed, and often bedecked with ribbons.

Each child was examined in good daylight. The lids were everted, and the conjunctiva examined with the naked eye. Almost every condition of follicle could be found—from forms only just visible as minute elevations which reflected the gleam of the light, up to forms which could only be considered as a state of hypertrophy. Yet these were in children whose eyes showed not the least trace of an inflammatory reaction.

Department.	Ages.	Number Examined.	Number with Visible Follicles.	Number with Hypertrophied Follicles.
			Per Cent.	
Infants (mixed)	3 to 6	342	144 = 42	1 only
Girls.. ..	7 to 13	328	232 = 77.3	4 „
Boys	7 to 13	341	178 = 52.2	4 „
Totals		1,011	554 = 58*	

It is evident from this examination that amongst children of the same class, parentage, and manner of life, the follicles are larger in girls than in boys. The visual acuity of each child had been noted at the same time; it was found that the acuity of the girls was not,

* Greeff found 70 per cent. in school-children; Delbès, 49 per cent. in boys, 52 per cent. in girls.

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on the average, so good as that of the boys, the boys having 82 per cent. good vision ($\frac{6}{6}$), the girls 74 per cent. good ($\frac{6}{6}$). I think this may in part be accounted for by the fact that the boys played about in the clean, wide streets, sharpening their wits and their physical senses, whilst the girls were kept at home to help in domestic duties. The same causes might reasonably be considered to bear upon this predisposition of the girls to an enlargement of their lymphatic structures.

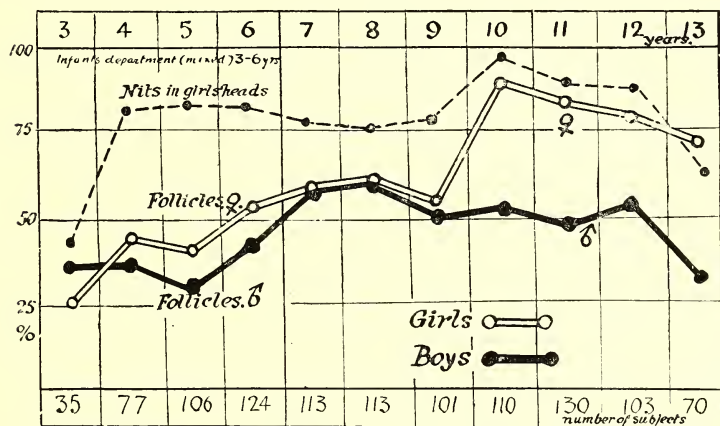


FIG. 26.—THE INCIDENCE OF VISIBLE LYMPH FOLLICLES IN THE CONJUNCTIVA OF HEALTHY SCHOOL CHILDREN.

Contrast boys and girls, and compare curve of follicular incidence in girls with that of the condition of the hair of the head in the same children.

When, however, the results of the examination of the conjunctival conditions in girls and boys were plotted down on a chart for each year of life (see Fig. 26), it was evident that this explanation could not fully meet the case, for it will be noticed that between the years three and nine the curves of incidence for boys and girls follow each other very closely, there is no noteworthy difference between them; the difference appears in the tenth year,

when there is a sudden and marked uprise of the curve of incidence in the girls, so that boys and girls are separated by full 30 per cent. In the subsequent years each curve declines, but they keep very fairly to a 30 per cent. separation. I could not conceive what this singular alteration in the curve of the girls could mean until I plotted out on the same chart the curve of incidence of the nits of *Pediculi capitis* in the heads of the girls; then it was seen that the curve of incidence of the nits was similar to that of the follicles in the girls. There is a fair average level between the ages of four and nine years, then a sudden rise of 20 per cent. in the tenth year, followed by a slow decline in the subsequent years.

Inquiries among the teachers elicited the information that it was about the age of ten years that the girls were expected by their mothers, many of whom were working women, to take up their share of the home duties. With this responsibility came the liberty to look after themselves as to their personal cleanliness and the like; hence the increase of the nits, an indication of neglect of the person, and with this an increase in the lymphatic structures as indicative of diminished good health. When personal pride comes in as a factor the person becomes cleaner, the curve of the nits falls, and with better cleanliness the curve of the follicles also declines.

The possibility of the onset of puberty affecting the condition of lymphatic structures was considered. It seemed, taking into consideration the general appearance of the girls, and our knowledge of English children, that the age was too early; it would not explain the similar increase of the nits. The simple explanation I have given is more in accordance with the known facts, and therefore more agreeable to the case.

Follicular Hypertrophy.

In the section on the lymph follicles of the conjunctiva I studiously avoided using the word 'folliculitis,' or any term that should indicate the existence of an obvious inflammation. Indeed, I specifically stated that the children in whom the examination for the incidence of visible lymph follicles was made had no signs of inflammation of the conjunctiva of any sort.

There were among the children some few cases (one infant, four boys, four girls) in whom the follicles were gross in their size, yet there were none of the signs, even in the least degree, of inflammation.

Recently three extreme cases of this kind have been seen at hospital. Two were in Jewish immigrants (males, aged twenty-seven and fifteen years) desirous of proceeding to America, but who had been inhibited by the shipping agent; the third was a thirteen-year-old English lad.

In each case the follicles of the conjunctiva were as large and prominent as they well could be; they had a normal distribution; the lower fold was filled with rows and rows of large oval, pale bodies, each about 1 to 2 millimetres; the upper fold and angles were similarly crowded, and a few smaller ones were dotted here and there over the upper tarsus. In the Jewish boy there were also three small semi-gelatinous swellings on the upper ocular conjunctiva, well away from the fold; in the English lad there were many similar swellings, and the semilunar folds were enlarged by the same cause (it was the appearance of these folds that led the mother to bring the boy to hospital).

The epithelium covering these follicles was quite normal in appearance; the delicate conjunctival vessels could be

seen passing over them in their normal course. Both man and boys stood straight, and looked as bright-eyed as any of us ; the one uniformly noticeable feature of their condition was their marked anæmia. Of symptoms associated with the eye condition there were none—no heat, no redness, no swelling, no pain, no discharge, no increase of tears, no excess of blinking, no pannus, no ptosis. There was no feature that could be pointed to as abnormal except the size of the follicles.

A very complete bacteriological examination was made of the conjunctival secretions and the expressed follicles in the Jewish man and boy. All cultures were sterile, with the exception of one tube inoculated from the man : therein was found a single colony of *Staphylococcus pyogenes albus*.

The cases were shown round at hospital. The opinions were various: some said trachoma, others could not tell ; some said it was not trachoma. The last, I must confess, were in a minority.

The Jewish boy was taken into hospital. The right upper fornix was excised, the follicles of both eyes were expressed with vigour, and the conjunctiva brushed with a tooth-brush soaked in 1 : 1,000 perchloride of mercury ; the reaction was checked with ice compresses. In a fortnight he again appeared open-eyed in the out-patient department ; his conjunctiva was free from follicles, but it was covered with bands running from the lids to the ocular conjunctiva.

The other two cases I treated in the out-patient department. The follicles were expressed in the gentlest fashion possible, and the mucosa lightly rubbed with blue stone twice a week ; subsequently zinc chloride drops were used to whiten the conjunctiva. In a month from the time of the expression the eyelids were normal in appear-

ance; there was no scarring, save for the fine line which marked the site of a portion excised for histological examination. The man left for America, and since he has never reappeared, I judge he passed the immigration officers; but the boy, who was treated by 'brossage,' can never get to America—his scarred conjunctiva tells a tale which will bar him at every port.

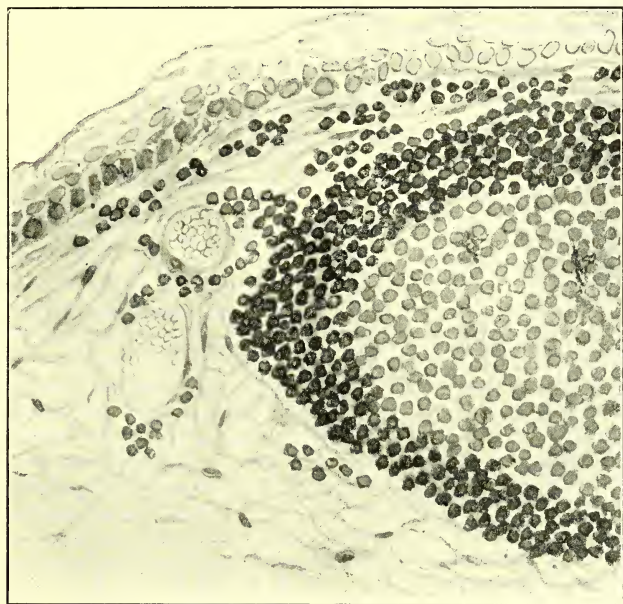


FIG. 27.—SECTION FROM CASE OF FOLLICULAR HYPERTROPHY.

Hebrew, æt. 26 years, recently arrived from Russia. Both eyes crowded with large semitranslucent lymph follicles. There were no subjective symptoms. The section shows a normal mucosa, except for the great size of the follicles; but these have normal histology. There is no excess of stroma, no signs of capsule formation. (The two triangular marks within the follicle are capillaries.)

Sections of the mucosa from the case of the man (Fig. 27) show an absolutely normal membrane, except for the monstrous size of the follicles; an epithelium of

normal thickness, with plenty of goblet cells; the mucosa and submucosa as delicate and free from signs of inflammation as can be. The follicles, although monstrous in size, conform exactly to the anatomy of a solitary follicle as seen, say, in the gut; the cells are soft and round, and packed in proper zones; there is no excess of stroma—it was so delicate it could not be drawn. In looking at the section, the remark I have already quoted of Brush, the discoverer of the follicles of the conjunctiva, that the follicles in Peyer's patches and those in the lower lid of the ox were identical structures, is irresistibly brought to mind. In the sections from the Jewish boy many of the lymph paths were dilated and filled with a clear, feebly staining substance, which accounts for the semi-gelatinous dilations of the ocular conjunctiva; these swellings disappeared after the 'brossage,' although they were not directly affected by it.

The feature of these conjunctivæ was an immense increase of the lymph cells of local origin; there was no leucocytosis of external origin. There was an abnormal development, or rather accumulation, of cells in the local follicles which have not passed in due course into the lymph stream. There was a 'lymph-follicle-stasis,' if I may use the term. Indeed, in both the boys there was direct evidence of a sluggish lymph circulation in the deposit in the ocular conjunctiva and semilunar folds, and in the dilated lymph paths of the sections. None of these features conform in any way to trachoma, which is characterized by a marked hyperplasia of the endothelial stroma of the follicles and general adenoid tissue of the mucosa; rather I see in them that hypertrophy which produces adenoids, enlarged tonsils, and the like, in children of feeble habit and ill-condition, induced by unnatural circumstances in food, housing, and air—conditions which were of the worst type in the three cases under review.

Occasionally cases of follicular hypertrophy are discovered in a school, and an alarm is raised. Such conditions of the lymph follicles are not contagious—that is, there is no danger of these cases setting up a viscous condition of the same or any other order in their neighbours. There is, however, a serious danger to the subject of the disorder ; he is much more liable, in the unhealthy and stagnant state of the local tissue and in his general ill-health, to fall a victim to any virus that may be about.

Looking through the many figures of ‘trachoma follicles’ in the works of various authors, I note in Greeff’s recent work a plate showing a section so described. It looks as if it had come from just such a case as I have detailed ; the section does not show any signs of an inflammatory condition, only enlarged follicles of apparently normal histology. Now, such sections could have been obtained from all the 563 children in the school of 1,011 whom I examined individually, for in all of them were found follicles visible to the naked eye in all stages, even to hypertrophy. If the condition figured by Greeff be trachoma, then all these children are condemned to the diagnosis, a conclusion which is absurd.

Follicular Conjunctivitis.

This is by no means an infrequent diagnosis ; the name has a weighty sound. Some see in the condition a very trivial affair, whilst others look upon it as a forerunner of trachoma.

A good deal of misconception as to the true bearing of such a train of symptoms has arisen from a neglect to take into account the condition of the rete mucosa and the follicles therein as they may be judged in the naked-

eye examination of average folk. The figures I have given from the examination of school-children in the previous pages show that a very large proportion of some sections of the community, and just those we see at hospital, present visible follicles. If there should chance to occur a simple conjunctivitis in any one of these subjects, all the features of 'follicular conjunctivitis' would appear; but had the same causal agent produced an inflammation in a person whose conjunctiva was without visible lymph follicles, the condition would have been called conjunctivitis only. The term, then, makes a distinction which is not just. Again, there are cases in which the inflammation of an otherwise clean-looking conjunctiva is followed or associated with a rapid swelling of previously invisible lymph follicles, yet our use of the term 'follicular conjunctivitis' does not allow any distinction between these cases, which might, perhaps, fairly warrant such a denomination, and the many other cases where a simple catarrh is grafted upon a condition of follicular hypertrophy. The diagnosis implied by 'follicular conjunctivitis' is therefore defective; it does not take into consideration the frequency with which enlarged follicles are seen in healthy subjects; it gives no indication whether the case is to be regarded as a simple catarrh occurring in such a subject, or whether the examiner conceived it to be something of a more serious nature.

Among the cases investigated bacteriologically I have twelve consecutive cases diagnosed 'follicular conjunctivitis.' In seven the brief history of acute symptoms indicated a catarrh on a condition of follicular hypertrophy. The determining causes of the inflammation were found to be Koch-Weeks bacillus twice, Morax-Axenfeld bacillus once, *Streptococcus brevis* once, staphylococci thrice. In all these cases the diagnosis of a mild

conjunctivitis was certified by the rapidity with which recovery was made.

In the remaining five cases the diagnosis was uncertain—‘follicular conjunctivitis or trachoma’—by reason of a somewhat lengthy history and the appearance of visible papillary ridges on the upper tarsal conjunctiva, whether from a brief inflammatory swelling or from an overgrowth through chronic inflammation could not be determined. Of the five cases, three recovered rapidly, and were finally diagnosed simple conjunctivitis, whilst one proved to be trachoma of the usual chronic form, and one remained in doubt.

It is, of course, a perfectly fair criticism to call in question a determination resting so largely upon duration of symptoms, and the ease with which we can control them. The inclination to be sceptical of the truth of a diagnosis of trachoma in cases which rapidly clear up is based upon our experience of the chronicity of cases of indisputable trachoma even under efficient treatment. But, as a distinguished surgeon with an unequalled knowledge of the disease in England said to me recently, ‘trachoma must have a beginning; it is not unreasonable to suppose that treatment of it at the beginning will abort the attack, and cut off the possibility of the more chronic symptoms.’ Doubtless this is true. The risk of an accidental contraction of a purulent conjunctivitis of gonorrhœal origin may be prevented by simply washing out the infecting pus at the time of its entry to the conjunctiva—all reaction may be prevented. As Vetch writes: ‘Dr. Walker and Mr. Peach got the matter conveyed by accident to their eyes, but by careful washing it was prevented from producing the disease.’ And the efficient treatment of the acute purulent condition at an early stage will materially reduce the liability to a long-continued trachomatous after-condition.

CHAPTER XVI

TRACHOMA

TRACHOMA means, a roughness of the conjunctiva. The name is a good one. In typical cases the roughness of the tarsal region is almost uncanny. The term is an old one, and the disease is old. Rowley, amongst his 'One Hundred and Eighteen Diseases of the Eye,' gives the following definition :

'*Trachoma* is an asperity on the internal superficies of the eyelid. The effects are sore pain and a violent ophthalmia, as often as the eyelids move. *Trachoma carunculorum*, which arises from caruncles or fleshy verrucæ growing on the internal superficies of the eyelids. This species is called *morbum palpebræ internæ*, because tuberculous internal superficies appear of a livid red like a mulberry. Others call these carunculæ *pladורות*.'

'It is cured by cutting off the caruncles with scissors, or by destroying them carefully with spiritus nitri fumans.'

There are allusions to the chronicity and induration of such cases in other writers, as Plenck ('*De Morbis Oculorum*,' Vienna, 1777). There is, then, definite record of a rough chronic condition such as we now call trachoma.

At the beginning of the last century came the epidemics of Egyptian ophthalmia, and an awakening of interest in

eye disease; so few remembered previous cases of such acute conditions that the epidemic was thought to be a new disease. But, as Vetch puts it :

‘ In the works of Hippocrates, but still more in the later authors of the Greek school, as Ætius, Paulus Ægenetus, Alexander Trallianus, and some others, the history of the ophthalmia which prevails in modern Egypt, and which has now appeared in this country, can be distinctly traced. . . .

‘ The earliest authors of our science have described these forms of ophthalmia with an accuracy which will not likely be surpassed in the present time.’

There is one quotation from Celsus which must be reproduced :

‘ *Pejus etiamum est,*’ (genus videlicet lippitudinis) ‘ *ubi pituita pallida aut livida est, lachryma calida aut multa profluit, caput calet, a temporibus ad oculos dolor pervenit, nocturna vigilia urget, si quidem sub his oculos plerumque rumpitur, votumque est, ut tantum exulceretur. Intus ruptum oculum febricula juvat. Si foras jam ruptus procedit, sine auxilio est. Si de nigro aliquid albidum factum est diu manet. At, si asperum et crassum est, etiam post curationem vestigium aliquid relinquit* ’ (Lib. VI., cap. vi.).

‘ Egyptian Ophthalmia ’ (1798-1810).

It seems a necessary preliminary to the discussion of trachoma to examine the records of this great epidemic—to judge what the cases really were when our more detailed knowledge of causes are applied.

As I have indicated before, I find in the work of Vetch such excellent and discriminating observations that his testimony will be appealed to for the most part. He was

on duty through the greater part of the chief epidemic in England. His statement of the case is as follows :

A battalion of raw troops—52nd Regiment—who had just been raised were stationed at Hythe, and there developed a disastrous purulent affection of the eyes. ‘They were,’ he writes, ‘in a tolerably healthy state for a corps so lately raised. . . . *Excepting a great proportion of venereal cases,** no particular distemper seemed to prevail, and the number in hospital were rapidly decreasing when the first case of ophthalmia made its appearance.’ Vetch at once put out of account ‘exposure to reflection of the sun’s rays from the shingle and the great quantity of fine sand which a long prevalence of blowing weather carried from it.’ Three other battalions located there were unaffected.

He noted, however, and thought there might be some bearing on the case, that the diseased troops lodged in quarters previously used by troops similarly but slightly affected, and that these men had come from Egypt.

Then he describes the disorder with remarkable lucidity. The intensity of onset ; the severity of œdema and chemosis ; the intense vascularity ; the profuse purulent discharge—like urethral discharge—to several ounces in the day ; the ‘hypersarcosis’ of the conjunctiva ; the ulceration and perforation of the cornea ; ‘the swelling of some lymphatic glands about the articulation of the lower jaw’—all these are typical of acute gonorrhœal ophthalmia.

If any other evidence than the foregoing be wanted, there are the pictures published by Vetch in his two books. They are clearly (save one†) those of gonorrhœal

* The italics are mine.

† Fig. 2. This is referred to again later.

ophthalmia. His description, his pictures, and his admission of the excess of venereal disease amongst the troops affected, make it impossible to arrive at any other conclusion.

There are also the remarkable observations of Vetch on the liability of such subjects to a succession of gonorrhœal urethritis, purulent ophthalmia, arthritis, and iritis, which Mackenzie stigmatizes contemptuously as a 'notion' and 'a good example of hasty generalization in regard to diseases between which no other relation than that of concurrence has been pointed out.'

In somewhat similar fashion the brilliant conclusions of Vetch of the essential contagiousness, in origin and propagation, of the disease, and not by atmospheric conditions—miasma, effluvia, and such like—were tarnished by later writers. They either lost faith, or failed to grasp the meaning of his deductions, and admitted the possibility of the Egyptian epidemic being an 'atmospheric conjunctivitis becoming degenerated into an infectious and contagious disease.' In narrating the horrible story of the French slave-ship *Rôdeur*, Mackenzie states that he 'regards it as a fearful instance of puro-mucous conjunctivitis excited by atmospheric influence spreading by contagion.'

Again, Napoleon landed in Egypt in July, 1798; his troops suffered severely from a violent epidemic of ophthalmia. The condition of affairs was something like the following: He had an army of men in whom the effects of revolution had loosened most obligations other than those of patriotism. Quartered in such a country as Egypt, amidst a teeming population, could these men escape venereal disease? Planted in such a place, in a time when war dissolved the distinction of *meum* and *tuum*, they could not be otherwise than severely affected, if in recent days

our army in Egypt, made up of men to whom early training and example gave at least some advantage, was badly affected.* It is, therefore, not unreasonable to conclude that the earlier epidemics among the troops in Egypt, which are described in terms essentially like those which I have quoted from Vetch of the English epidemic, were, as was confessedly the case in the latter, associated with an excess of venereal disease.

Does the conclusion that these epidemics were purulent ophthalmia, such as we now know to be directly due to the inoculation of the *M. gonorrhææ*, eliminate the possibility of the presence of our milder but chronic trachoma at this period, either independently or as some possibly associated condition? I do not think so. The trachoma we know was described before these epidemics; Vetch also indicates the existence of milder, more prolonged attacks during the epidemic he witnessed.

There is one curious point to be found in the pictures of Vetch in this connection. Look at Fig. 2 of the plate of his first book of 1807. Is this not certainly the wedge-shaped pannus of our trachoma? It is a very different thing to the general corneal infiltration of purulent inflammation he places beside it in Fig. 3. It is also worthy of note that he omits this particular figure of the wedge-shaped pannus from his book of 1820, but reproduces the others, and publishes further figures illustrative of the corneal staphylomata and other typical sequelæ of the gonorrhœal condition.

It almost seems that the experience of later years led

* In South Africa my experience was that there occurred little venereal disease; the social level of the troops was materially raised by volunteers, and the population is sparsely scattered: yet recently attention has been called by Dr. Gregory (M.O.H. for Cape Colony) to an alarming increase of disease succeeding the war (*British Medical Journal*, October 29, 1904, p. 1196).

Trachoma



him to view the epidemic disease as more akin to the gonorrhœal conjunctivitis, so that he left out the picture of a pannus which he had perhaps come to associate more with a chronic disease than the acute contagions.

Vetch writes in 1807: 'In external appearance it (Egyptian ophthalmia) bears a strong resemblance to the affection which Mr. Ware has described with much accuracy as peculiar to children; from the similarity of that affection we learn the general tendency of the parts to assume this form of disease, while the peculiarities of the present affection may be ascribed to the specific nature of the cause. Its more general features bear a marked affinity to those which characterize a common affection of another secreting membrane. Gonorrhœal ophthalmia, as described by authors, bears not only a general resemblance to this, but occasionally observes a periodical form in the return of its pain.' He then details the likeness of the clinical symptoms.

From this quotation it would seem that Vetch was not personally familiar with the ophthalmia of the new-born, or with gonorrhœal ophthalmia in adults, or, at least, not to any extent. One is justified in thinking that, had he the benefit of this experience, he would have got even nearer to the whole truth of the nature of these diseases than he did.

Then, Mackenzie (p. 369) writes: 'There are no marks which can be absolutely depended on by which to distinguish gonorrhœal ophthalmia produced by inoculation from Egyptian or contagious ophthalmia. The symptoms, in rapidity and severity and the dangers to the cornea, are the same. The treatment ought to be the same for both.' The only ground for a differentiation he can find is 'in the history of the two diseases.' The fallibility of such evidence is notorious.

Although there have been, happily, no more such violent epidemics of ophthalmia as these discussed, yet the condition still exists in a modified form in Egypt and Palestine.* Koch, in 1883, noted the frequency of the presence of *M. gonorrhææ* in such cases, and discovered his slender bacillus (Koch-Weeks bacillus). The association of these organisms with cases has been repeatedly demonstrated down to the recent work of L. Müller.

Returning to the epidemics recorded by Vetch and others, we find records of the persistence of a chronic condition after acute attacks. Mackenzie writes (p. 347) :

‘In many cases, and especially in those who have suffered repeated relapses, the symptoms which are the latest to disappear are the enlarged and indurated state of the mucous cryptæ of the conjunctiva of the eyelids . . . and the vascular and nebulous state of the cornea, depending on the constant irritation produced by the friction of the diseased eyelids upon the eyeball. The state of the conjunctiva has generally received the name of *granular conjunctiva*.’†

‘It is a fact particularly worthy of notice that a patient may remain many months with the conjunctiva of the eyelids in the granular state, his corneæ probably vascular and nebulous, but without any puriform discharge, and after a fit of intoxication or some other irregularity the inflammation shall suddenly return in its original form, and with its original propagative power. Hence it may

* Recently I conversed with a member of the Palestine Exploration Fund Expedition. He said ‘a labourer with two sound eyes was a rarity.’

† *Granular*.—Both Vetch and Mackenzie point out that the name is a misnomer in so far as it would imply the presence of pathological ‘granulations’—*i.e.*, vascular tufts, sprouting from a raw surface. Vetch refers to the ‘granulated appearance’ of the conjunctiva. It is probable that the term had originally less a pathological than a descriptive significance.

happen that a soldier discharged in the state described, returning home into the country, and there from intoxication becoming affected with a relapse, may give rise to an ophthalmia which shall spread through many families and present all the symptoms and the severity of the true Egyptian disease.'

We therefore come to a stage when, under certain conditions, the disease assumed a chronic form, characterized by a rough, indurated conjunctiva and a vascular cornea. There was still a liability to exacerbations, when the chronic form was shown to be as contagious as the acute epidemic form.

That the virulence of the contagion in these chronic forms was reduced I think we may fairly assume, else the epidemics would have continued in unabated force. History, and such remarks as those of Mackenzie, show they did not ; and it is evident from the writings of the time that the illumination of the few did not become the universal possession, so that we cannot count alone for the decline of the disease by the use of efficient remedial measures or precautions.

Present-day Trachoma.

Coming to the trachoma of our own time and of our country—for it is that which must concern us most—we find a chronic disease of moderate severity, yet producing much irritation and damage.

The swollen lids, the grossly roughened conjunctiva, the pannus of the cornea, all indicate a marked and chronic irritation. Occasionally the outward signs of irritability, so commonly shown in the patient's expression and the general condition of the adnexa, are small, yet examination of the conjunctival tissue shows there is a

specific irritability in the exaggeration of the tissues of the part.

The disease is rare in England. It is no rash statement to say that, were it not for the continual influx of immigrants, the subjects of the disease, we should be able to consider it well-nigh extinct.

Among the 22,000 children in the Board Schools of Hackney,* whom I personally examined in 1903, there were only three cases of trachoma; two were certainly, the third probably, trachoma. These three cases occurred in the worst district of London I have seen, where the type of house construction was horrible in the extreme, and overcrowding rife, with all its attendant evils; in comparison, Bethnal Green and Ratcliffe Highway seemed salubrious regions.

Amongst the 1,600 cases of the Belgrave Hospital, which were drawn from the local, native, and rather isolated population of Pimlico (London), there was but one case of trachoma in ten years.

Amongst the 2,757 Moorfields cases seen in 1902 (being one-twelfth of the total out-patients for the year), there were 14 cases of recent disease and 19 of old-standing conditions resulting from trachoma (Fig. 28). Of the 14 recent cases, only 3 were in native patients! There were, amongst the 2,757 patients, 2,124 natives; of these, only 0·14 per cent. were affected with recent trachoma. The proportion of recent disease in the aliens was more than ten times as high, being 1·6 per cent., or 11 cases in 627 subjects.

The incidence of the disease in school-children of the

* There were no alien schools amongst those visited, and the aliens in the schools were few in number. Since this date I have examined twice as many more children. I have only found two further cases of trachoma—*i.e.*, five cases in a total of 70,000 children of ages from seven to fourteen.

poorer classes, and in native patients in two hospitals widely separated in location, is therefore shown to be very small. When the disease is found, it is almost invariably found amongst the poor, dirty, and overcrowded—those who from circumstances habitually neglect the care of the person.

There is a mass of evidence to show that the epidemic of Egyptian ophthalmia, which resulted in chronic forms like unto our trachoma of to-day, was of gonorrhœal origin. We have, however, no such cumulative evidence of gonorrhœal origin for the trachoma of our time and

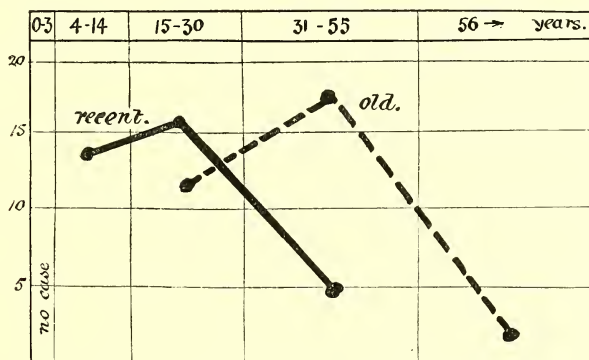


FIG. 28.—THE CURVES OF INCIDENCE OF TRACHOMA CASES OF RECENT ORIGIN AND OF LONG STANDING APPLYING FOR TREATMENT FOR THE FIRST TIME AT THE MOORFIELDS CLINIC (1902).

land. Cases of purulent ophthalmia due to the *M. gonorrhœæ* occur in infants and adults, but they are so assiduously treated that it is rare for a chronic 'gleety' condition, as Vetch describes it, to persist as a source of infection to others. There are, however, cases recorded which perfectly fit in with such a causation.

The Essential Contagiousness of Trachoma.

There are numerous instances of epidemics of a lesser severity than that styled 'Egyptian,' but these are hardly

to the point here. That recorded by Goldzieher is more impressive: In a blind school at Buda-Pesth an epidemic of all forms of trachoma developed and spread through the scholars subsequent to the introduction of a boy recently blinded from acute purulent ophthalmia.

Sattler records a case wherein a mother with leucorrhœa gave birth to a child which developed a moderate purulent ophthalmia. Subsequently the mother acquired a typical trachoma; the region of the occurrence was free from trachoma.

My own experience in the scarcity of trachoma at home is not wide enough to provide much material, yet I have details of one occurrence which is very much to the point.

In one of the London County Council blind schools which I examined in 1903 I found three cases of trachoma. One was an old case of typical chronic trachoma with mixed characters and pannus; the discharge was slight. The boy said he had been 'blind' for one year (he now sees $\frac{6}{8}$ after treatment at Swanley); by some mistake he had been drafted into the school. Of the other two, one, a lad previously blind from optic atrophy, had certainly quite recently contracted the disease—there was commencing pannus, large papillary growths covering the upper tarsal conjunctiva, and discharge from each eye: the boy had been seen not long before my examination, and he was then free from disease. The third boy was in a similar though rather more advanced condition, but of him there was no previous history; he had not long been at the school.

Although I cannot prove the communication of the contagion from the first boy to the second, yet it is as difficult to refute the presumption, especially in view of the greater liability of blind children, from their habit

of fingering each other and their own eyes, to propagate contagion.

Bacteriology.—I have examined 41 cases of the disease in England; of these 36 were recent cases, and 5 cases were inflammatory conditions occurring in old and scarred cases.

In all cases where circumstances permitted the procedure was as follows :

1. Inoculations and film preparations were made from the conjunctival sac or discharge.

2. The conjunctiva was washed by sponging or vigorous irrigation, and some part of the tissue of the diseased lid removed by expression or scraping, and inoculations and films made therefrom.

Cultivations were made in the usual manner on blood serum (horse), plain agar slopes, and in blood-mixed inoculations on the latter medium.

In six cases no organisms were obtained; some of the cases had been previously treated, a difficulty always present in a city of many hospitals. In two other cases single colonies of *S. p. albus* were obtained.

The organisms found in the recent cases were as follows :

Organism.	Sole Organism.	With Others.	Total.
Koch-Weeks bacillus	2 (1 other ?)	11 (1 other ?)	13 (2 ?)
Xerosis bacillus ..	—	5	5
Morax-Axenfeld bacillus	—	3	3
B. Coli communis ..	1	2	3
S. p. albus (many varieties)	8	14	22
S. p. aureus and subflav... ..	—	4	4
Other organisms of no importance	—	4	4

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ORGANISMS IN INFLAMMATORY CONDITIONS OF OLD AND SCARRED TRACHOMA.

Organism.	Sole Organism.	With Others.	Total.
Koch-Weeks Bacillus ..	—	1	1
Diphtheroid bacillus ..	—	1	1
Morax-Axenfeld bacillus	1	1	2
B. coli communis ..	1	—	1
S. p. albus	—	—	—
S. p. aureus and citreus	—	2	2
Other coccus	—	1	1

I made particular note of any variability found in the cultural results in inoculations from the sac and in inoculations from the tissues of the diseased conjunctivæ. In several cases more colonies were grown in inoculations from the scrapings than from the secretions, but this was not a constant result. The occurrence in some cases may be accounted for by the liability to the retention of organisms within the crypts of the papillary folds; that such a supposition is likely is shown, I think, by the following details of a case of the indolent type of trachoma:

A particularly careful, prolonged, and vigorous washing was given to the conjunctiva with boiled saline solution under pressure of 3 feet; the water was projected from a nozzle with considerable force; a shield prevented splashing.

Culture from unwashed sac = 1 colony, staphylococcus.
 „ „ sac after washing = 18 colonies „
 „ „ scrapings of papillæ = 4 „ „

The film preparations of the scraping show, besides numerous epithelial, endothelial, and lymph cells, some oval masses of smooth light-brown, badly-staining substance with many cocci therein, all paired; in one such

mass twenty pairs were counted. The cocci were highly refracting, with areolæ almost like capsules. These masses I judged to be some of the accumulations from the crypts of 'Henle's glands.' The organism recovered in all the cultures was a staphylococcus of fair size, non-liquefying, growing slowly but for a long time; it stained by Gram's method.

In thirteen of the recent cases the Koch-Weeks bacillus was present alone or with other organisms; in two other cases bacilli of similar but not certain identity were found. In those early cases where the diagnosis was often a matter of difficulty there was a greater incidence of this organism than in the more advanced and certain types of the disease. Eliminating the eight cases in which nothing or next to nothing was obtained, there remain twenty cases in which a variety of organisms were found: The *S. p. albus* of several types were most often obtained. In a couple of cases with signs which all agreed to be trachoma, and with considerable discharge, the *Bacillus coli communis* was found, in one case in pure culture. In no case was I able to demonstrate the presence of any organism agreeing with the characters of the *M. gonorrhææ* of Neisser.

The experiences of others in this work have been as follows:

Koch (1883) examined fifty cases in Egypt. He found the *M. gonorrhææ* associated with severe ophthalmia, and his bacillus (Koch-Weeks) with milder forms.

Sattler (1885) and Michel (1886) made observations on a new coccus which they thought a causal agent, but the researches have not been confirmed.

Kartulis (1887) corroborated Koch's observations, but inclined to a gonorrhœal origin for trachoma.

Demetriades (1894) considered the Egyptian ophthalmia a combination of trachoma with purulent ophthalmia. He found the gonococcus constantly in the discharge.

Griffith (1901), in cases occurring in Liverpool, never found the gonococcus, but in a large proportion obtained the Koch-Weeks bacillus, which he believed to be the determining cause of the milder, more chronic trachoma of this country. He narrates an interesting observation: Six patients suffering from a catarrh of Koch-Weeks bacillary origin 'were left for a month without treatment to see if residence in the country with plenty of fresh air and good food had any influence in causing the disappearance of the small miliary granules.' It was then found that, instead of having diminished in size, the granules had undergone a very appreciable enlargement, and the whole of the upper palpebral conjunctiva was studied with pale pinkish elevations. The Koch-Weeks bacillus was obtained in five of the cases, and seen in the sixth.

L. Müller, in a massive work conducted in Egypt and at Vienna (1900-1903), examined 352 cases. He concluded that there were almost always several organisms present in Egyptian ophthalmia—the gonococcus, Koch-Weeks bacillus, Morax-Axenfeld bacillus, or the pneumococcus, with other cocci. He agreed with Koch in ascribing a great influence to gonococcus and Koch-Weeks bacillus, particularly the former organism. He, however, sought to show that the essentially trachomatous nature of the disease was due to none of these organisms, but to a bacillus—his 'trachom bacillus.' The organism he described is like the Koch-Weeks bacillus in that it is extracellular and does not stain by Gram's method, but unlike it in that it is slightly shorter and thicker. Other differences he found in the inability to grow his

'trachom bacillus' on media without hæmoglobin, and in the water-clear character of the colonies, the Koch-Weeks bacillus, on the contrary, growing on blood serum and forming colonies slightly opalescent. He also differentiates the condition of the cornea in the presence of these organisms, ascribing the production of pannus to his organism, and of necrotic changes to the Koch-Weeks bacillus.

So far he has not been able to convince other workers that the features of his organism are not equally characteristic of the Koch-Weeks bacillus; that is to say, there is an equal variation in morphological and cultural features of the Koch-Weeks bacillus derived from ordinary muco-purulent catarrhs. This was the view I formed on reading his work, and since then I have seen the criticism to the same purport by Axenfeld. Whether it be a correct opinion it is difficult to determine, and it is equally difficult for Müller to strengthen his position, owing to the lack of facility in dealing with these organisms.

For the present, then, we may take it that the bacteriological examination of trachoma points in the direction of a causal connection with either, or possibly both, the *M. gonorrhææ* or the Koch-Weeks bacillus. It does not appear possible, with our present knowledge, to conclusively determine this matter.

There is, however, one point to which notice should be given—the variability of the tenure of existence of the two organisms in the tissues they have invaded either with or without antiseptic treatment.

1. *M. Gonorrhææ*.—The time during which urogenital mucosæ, once infected, may remain a source of infection without showing any signs of the residence of the organism, is notoriously long. The evidence I have quoted from Vetch, Mackenzie, and Goldzieher as to

the prolonged contagiousness of the secretion of the conjunctiva in patients apparently recovered from purulent inflammations could be extended by many cases.

In one case of my xerosis list, a baby, aged nine weeks, had suffered from ophthalmia of the new-born from the second day of life, and been treated with solutions of silver nitrate for two months. At the time of my seeing it there was no discharge, but a thick curdy deposit lay in the depths of the fornices. This deposit contained myriads of *M. gonorrhææ*. In film preparations two organisms were seen—cocci of one sort and the xerosis bacillus. The cocci were most numerous, and indistinguishable from the gonococcus by all morphological tests. Xerosis colonies in enormous numbers were obtained in culture, but no cocci of any sort. Had the cocci seen in the films been any other than the gonococcus, I think there would have been a growth along with the xerosis organism.

In two other cases of ophthalmia of the new-born still in the discharging state the discharge was examined after the eyes had been efficiently swabbed at the hospital for ten consecutive days with a 2 per cent. solution of silver nitrate, together with the free use of 1:5,000 perchloride of mercury solution every three hours. In both cases the film preparations were crowded with the gonococcus, and in one case the organism was obtained in culture.

The *M. gonorrhææ* is, therefore, remarkably tenacious of its hold on any mucous surface it infects; this is without doubt due to the way in which it penetrates the intercellular cement substance of the epithelial layer.

2. *Koch-Weeks Bacillus*.—Griffith records six cases in which, without treatment, the organisms were still present

after one month. Hoffmann supposes the organism is able to lie dormant between the papillæ of the tarsal conjunctiva from one attack of muco-purulent catarrh to another. Griffith records a case which would fit in with this supposition. In my experience, when efficient treatment is undertaken, it is rarely that one has difficulty in ridding the mucous membrane of the organism—at least, as judged by two signs: (1) the reduction of the symptoms; (2) the non-appearance of the organisms in film or cultural preparations.

In Case 135, of papillary trachoma, at the initial examination Koch-Weeks bacillus was obtained in culture; fourteen days later, after two separate applications of silver solution and the intermittent use of mercurial lotions, no organisms were found in films or cultures.

In Case 169, of a severe muco-purulent catarrh, at the initial examination Koch-Weeks bacillus was obtained in culture. After one month, during which silver solution had been used twice and zinc chloride lotion freely, no organisms were seen in the film preparations. Three months later marked ectropion was found; examination of the thickened mucosa discovered no Koch-Weeks bacilli in film or culture, but numerous cocci and xerosis bacilli.

These observations do not preclude the possibility of Hoffmann's supposition, but they show there is no support for it where efficient treatment is undertaken; on the contrary, a great pertinacity can be shown for the *M. gonorrhææ* without difficulty. The Koch-Weeks bacillus is destroyed with ease, for it is an extra cellular organism; the gonococcus with difficulty—it is intra-cellular, and penetrates deeply the interstices of the cellular cement substance.

The characters of these two organisms, in so far as tenacity indicates the power of a chronic exciting influence, leave a balance of probability in favour of the *M. gonorrhææ* being the cause, or most efficient cause, of trachoma.

The relation of these two organisms to the papillary condition of the conjunctiva in England may be expressed by the following scheme.

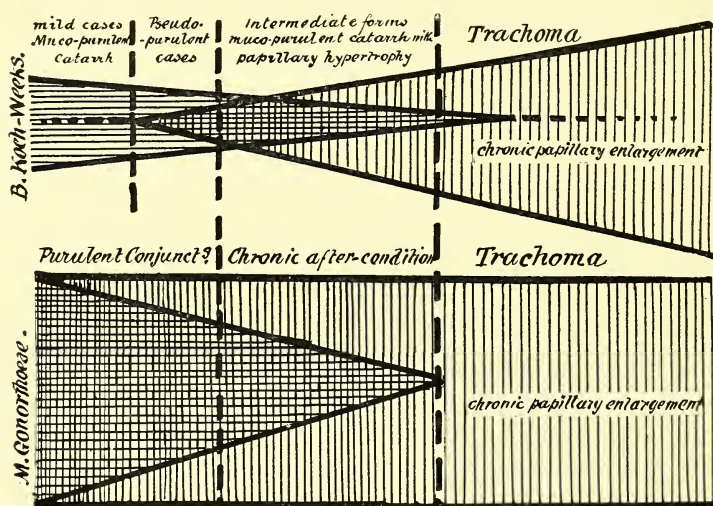


FIG. 29.—SCHEME TO SHOW THE RELATION OF THE TWO ORGANISMS—*B. KOCH-WEEKS* AND *M. GONORRHÆÆ*—TO CONJUNCTIVITIS, PAPILLARY HYPERTROPHY, AND TRACHOMA.

In the majority of cases where the conjunctiva is invaded by the Koch-Weeks bacillus there is no papillary hypertrophy. In the severer cases approaching a purulent type the hypertrophy is found; and in a number of cases of an intermediary type there is both the bacillus and the papillary growth. In a considerable number of cases which no one would hesitate to call true trachoma the organism is found.

In all cases of infection with the gonococcus there is a marked papillary growth both in the acute purulent stage and in the chronic stage succeeding. The same papillary condition is found in trachoma, but the gonococcus has not been demonstrated therewith in England, though it is present in apparently identical conditions in the East.

The Clinical Features of Trachoma.

As seen in England, cases of trachoma vary considerably. We are accustomed to distinguish forms in which the papillæ, or folds of the upper tarsal conjunctiva, are hypertrophied so as to form a pile easily distinguishable to the naked eye, from one of a light and velvety order to others of a distinctly 'cauliflower' form. In the early stages of these conditions the mucosa is rough to the sight, but not rough to the touch; in the later stages, particularly when untreated, the pile becomes denser and rough to the touch, almost like shark skin. In other cases the pile is less in evidence, for the conjunctiva is studded with numerous swollen lymph follicles, which tend to catch the eye of the observer.

These distinctions have led to a classification of 'papillary' and 'follicular' forms;* a further class of 'mixed' trachoma has been made to include cases which exhibit equally these characters. The anatomical features underlying these distinctions were noted by the observers of the great Egyptian epidemic; they did not appear to attach much importance to them; the distinctions have only come into vogue since the chronic form has been the rule. Some have sought to discover

* I purposely avoid the term 'granulation' or 'granular' in this classification, as it has been used to describe both papillary and follicular conditions.

not only variations in the manifestations of one disease, but the evidences of separate diseases.

The examination of histological sections by many workers has dispelled this idea ; for there has never been found a case in which both these anatomical features could not be demonstrated. The naked-eye differences arise from a greater or less prominence of one or other feature.

Rarely cases are seen where the fold and upper tarsal surface is covered with a thick, smooth, bluish-gray mass. Stellwag describes it as a 'brawny trachoma.' It is said to be a later stage of the massive papillary type. An example of this condition, in a Jewish girl, appeared at the clinic at Moorfields a year ago. When I applied expression forceps to the mass, it opened at a number of points, and numerous follicles were expressed ; it then exhibited a flabby papillary character.

The discharge in the cases seen at home is rarely much in quantity ; it seems to vary considerably, even in untreated cases. If we may judge by the history of fairly intelligent patients who come for treatment in considerably advanced stages of the disease, there has been no noticeable discharge, save that which a long-continued gumming of the lids in the morning will indicate, until within a few days of their application. In the case of the boys found in the School for the Blind, and who had been in presumably observant hands throughout, no discharge had been noticed until the preceding week. It is possible that the increase of discharge may be due to the accession of purulent or other organisms to the diseased conjunctiva. The fact that I have only obtained the Koch-Weeks bacillus in cases of } undoubted trachoma where there has been this rather sudden increase of discharge in a previously existing trachoma which did not discharge,

and that I have not found the organism in cases of trachoma which did not discharge, leads me to question if the presence of the organism with the discharge is not perhaps due to a temporary accession of the organism, rather than that the trachoma is due to the continuous presence of the organism in the conjunctiva, as the hypothesis of Hoffmann and the observations of Griffith would indicate.

The Pannus.—The infiltration of the cornea in trachoma has received many names, as the changes vary in intensity, thickness, or in vascularity.

The essential condition is an infiltration of the superficial layers of the cornea between Bowman's membrane and the epithelium (Ritter, Raehlmann, Read). This is most clearly shown in a recent paper by Bietti, who figures in a beautiful drawing a section of a cornea; although the pannus is thick, there is very little infiltration below Bowman's membrane. To the naked eye the surface epithelium appears rough; the colour is gray, and transparency is lost; the invading vessels show up red in the infiltration, and give it, in proportion to their numbers, a pinkish hue. The vessels are extension from the loops normal to the limbus; at first they penetrate straight forward into the cornea, but speedily develop lateral anastomoses, and a network of vessels results. Some of the vessels become particularly enlarged, and appear then to be the continuations of the larger conjunctival vessels. Small ulcers not infrequently appear at the advance margin of the pannus towards the centre of the cornea, but not infrequently these appearances are due to a rumpling of the epithelium, for the hollow behind the wave-like edge does not always retain the fluoresceine stain on washing.

The cause of the pannus has long been a vexed question.

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There are two theories of origin — (1) mechanical, (2) trachomatous. On the mechanical theory, it is held that the infiltration is induced by the continual friction of the roughened cornea on the sensitive cornea. On the trachomatous theory, it is held that the pannus is part of the process of the disease, which has spread by some means from the upper lid to the cornea, producing a proper trachomatous infiltration.

The mechanical theory has numerically the greatest number of points in its support : The pannus begins on that part of the cornea with which the rough conjunctiva is most in contact, and only spreads to the lower part by continuity ; it may even not reach it. It is found in the cornea alone, an exquisitely sensitive surface, and not in the ocular conjunctiva, which is comparatively insensitive.* Junius figures a trachomatous nodule on the ocular conjunctiva, but it is so closely associated with the fold of transition that it is difficult, in the face of the general freedom of the ocular region, to believe it did not belong to the fold.

The discontinuity marked by the non-affected ocular region is against the theory of the spread of a proper trachomatous process to the cornea, as is also the fact that such a spreading would be against the flow of the lymph circulation, though this is not impossible granting a specific microbic cause. Fuchs meets the difficulty by presuming a direct infection from lid to cornea through contact. If this be so, why is not the ocular conjunctiva also affected ? He meets this by pointing out the greater vascularity of the limbus and its proportionally greater liability to infiltration. But I would note that the

* Twice within recent date I have seen cases wherein foreign bodies (one an oat-grain, another a piece of horse's hoof) remained within the upper cul-de-sac for fourteen days, and did no damage.

limbus is also the most sensitive region, so an infiltration is most likely to arise and be pronounced here from irritation alone ; once started in the limbus, it will naturally spread centripetally by reason of the altered nutrition of the corneal quadrant contiguous to the swollen limbus.

But there are cases where the conjunctiva is rough and there is no pannus ; and there is pannus with a comparatively or apparently smooth conjunctiva : how can a mechanical theory meet these variations ? I think we ought to distinguish what we mean by 'roughness.' The mucous surface of the small gut looks very rough on account of the numerous villous processes, but it is exquisitely smooth to the touch ; whereas the skin of a dogfish looks very glossy and smooth when fresh in its mucous unguent, yet it is very rough to the touch, and makes the most perfect polishing material ! I have seen many cases where the conjunctiva had large soft papillary growths and looked rough enough, yet it was quite smooth and soft to the touch ; there was then no pannus. In other cases the surface has looked fairly smooth and shining until it was felt, when a fine, shark-skin-like roughness, of which the sensation was horrible, was noted ; there pannus was found. In yet others the tarsal conjunctiva was uneven to the feel ; the infiltration of the papillary growths was such that they did not flatten down on pressure, but remained prominent ; such unevenness would be irritating to the cornea. In some cases the difference to sight and touch did not meet all the difficulties, perhaps because the sensibility of the finger is so much less than that of the cornea. I think the difference between ruggedness of appearance and roughness to touch has been overlooked in this connection.

Then there is the rapidity with which the pannus, provided it is not of very long standing, will clear up on

treatment of the conjunctiva, and on treatment of such a kind that the roughness to the touch is immediately reduced. In making cultures, I frequently scraped away portions of the papillary growth ; some patients expressed their opinion of the procedure in most pointed terms, but later on they were as warm in their praise of the benefit produced—they could see better. When the scraped area was examined, it was found to be covered with a smooth layer of epithelium, and the pannus was found to be lessened in density.

The infiltration of the pannus has been described as ‘soft tissue, extremely rich in cells, which greatly resemble the infiltrated trachomatous conjunctiva’ (Fuchs). Is not every infiltration of the cornea of a superficial type and spreading from the limbus of this same character—soft tissue, extremely rich in cells? I cannot find that there is anything in the new tissue peculiar to trachoma.

The discussion of these points of evidence seems to lend the greatest weight to the mechanical theory of origin. In the succeeding section I shall show how the trachomatous process is essentially an alteration in a lymphoid structure ; the ocular conjunctiva, in that it has no lymphoid tissue, is not susceptible to a ‘trachomatous’ infiltration ; so also with the cornea : it has no lymphoid tissue, and consequently an infiltration therein cannot show any proper trachomatous character.

Histology of the Palpebral Conjunctiva in Trachoma.

In examining the histology of any epiblastic structure there is one feature to be noticed—that the moulding of the cellular surface covering is determined by the nature of the underlying mesoblast : the skin papillæ, folds, and ridges are all dermal conformations ; the con-

trary only holds when the epiblast penetrates to form glands. As I pointed out in the section on general anatomy, the ridges and folds of the upper tarsal conjunctiva are due to the manner in which the mucosa is bound down to the denser tissue of the tarsal plate.

In the sections which I have from trachoma cases I find a series: There are those which exhibit a moderate degree of papillary exaggeration, in others this exaggeration is the marked feature; some show much follicular hypertrophy, others but little; and there are widely differing degrees of leucocytosis. But no one specimen is completely free from any one of these features.

Now, ridges and papillæ are normal to the upper tarsal conjunctiva; follicles are also a normal structure; the presence of lymph cells in the rete mucosa is also a normal anatomical feature; but the departures from the normal condition of these features in the sections of disease are manifest.

I shall consider one case only, and having pointed out the characters there found, see if any essential difference can be found in other cases, and to what degree.

CASE 128.—A dark, flabby, greasy-skinned Jewess of eighteen; 'refused passage to America.' Upper tarsus and fold covered with big soft, juicy, cauliflower-like papillæ, the largest I have seen. No reaction, no pannus, no perceptible discharge (she said there had been a slight stickiness of the lids the last day or two), no previous treatment.

The sections (Fig. 30) show a great alteration of the stroma. There is a general overgrowth of its elements. In some places this overgrowth is particularly marked, so that oval areas are formed, marked off by a capsule-like formation. These areas are filled with stroma, but do not contain any great number of lymph cells. The

peculiarity of the stroma, both within and without these areas, but particularly within the areas, is the presence of many large endothelial cells—that is, some cells of the endothelial stroma are enlarged beyond others. In the oval areas these cells are very large, have many processes, and numerous darkly-stained oval nuclei. No single

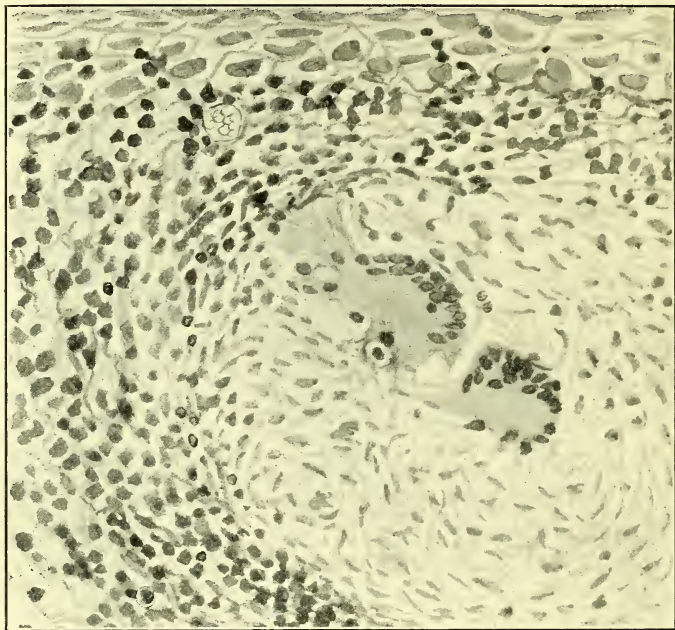


FIG. 30.—TRACHOMA.

Jewess, æt. 18 years. Both eyes affected. Section from upper retrotarsal fold, showing part of a 'follicle.' The leucocytosis is very slight, but the hypertrophy of the stroma, both in its individual elements and in the formation of 'giant' cells, is great. (Detailed description in text.)

part of these cells, such as a process, a nucleus, or portion of protoplasm, is abnormal; it is the massing of these parts in one cell which is abnormal.

Cells of this nature have been described by Villard,

Pick, Greeff, Junius, and others ; they have been thought to be peculiar to the condition.

Some have pointed out the presence of bodies or vacuoles within them, and conjectured the possibility of their being of the nature of blastomycetes. In the sections of this case what appear to be these vacuoles can be seen in the process of formation. Many of the processes of the great cells are in process of fusion. The fusion is irregular, spaces are left between the processes ; in other parts of the same cell lymphocytes are seen enclosed within the encircling processes. In other sections from this case even larger cells than those drawn are to be seen ; their features are, however, blurred, as though degenerative processes had set in.

Now, in the conjunctiva of the girl from which the tissue was excised there was no apparent reaction ; there was a history only of a slight stickiness of the lids for a day or two. No treatment had been attempted. These negative clinical conditions are reflected in the absence of any marked leucocytosis in the sections. The features of the stroma changes stand out prominently, and they are seen to be different from those found in simple and acute affections of the conjunctiva, even in those wherein the ridges of the upper tarsal conjunctiva are swollen so as to produce a papillary appearance. In fact, these features are those we are accustomed to recognise as associated with infective granulomata, yet the features of these sections differ from those of granulomata in that the whole of the tissue examined is similarly affected ; there is a diffuse change over the whole tissue, though there are parts in which is exhibited a greater degree of change than the general.

In sections from other cases the same overgrowth of

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the stroma with large endothelial cells can be seen, but these cases differ in that the stroma is crowded, almost hidden, by an intense leucocytosis, or else by a large leucocytosis and the presence of masses of lymphoid cells—overgrown follicles. The difference in the extent of the leucocytosis can be at once accounted for by a comparison of the clinical features of the cases : in the one there was no reaction, in the others there was a marked reaction. That leucocytosis is proportional to the intensity of the inflammatory reaction is too well established to need consideration.

In regard to the follicles, or collections of lymph cells of local origin, as distinct from the cells of the leucocytic invasion, I have already stated, in the sections on lymph follicles, follicular hypertrophy, and follicular conjunctivitis, that I do not consider the presence of follicles as in any way characteristic of any particular condition of the conjunctiva : they are normal anatomical features. They may be inflamed and swollen, or they may be enlarged, or even increased in number by a steady increase in the cells of the rete mucosa, owing to a delayed metabolism of the part in unhealthy conditions of life. And here in trachoma we have all these factors : there is a chronic inflammation, as witness the changes in the stroma ; there is a more or less brisk reaction, as witness the leucocytosis ; there is in all the subjects of trachoma an unhealthy condition of life, with all its consequent tendency to lymphatic hypertrophy.

I take it, then, that the follicles are in nowise 'characteristic' of trachoma ; they are but the exaggeration of a normal anatomical feature induced by the above-named factors ; they differ only from normal follicles in their number and size, and in the exaggeration of the stroma within them. It is this last-named character, the altered



Trachoma

stroma, which alone distinguishes them from the follicles examined in those cases I have classed as 'follicular hypertrophy.'

Some will object, But why is there the great tendency to encapsulation of these follicles pointed out by Fuchs, Read, Orth, Junius, Griffith, and almost everyone who has examined sections of the disease? My answer is that this is but an expression of the tendency of the overgrown stroma to shrink, and of course to shrink around any obstruction such as a follicular mass, and that this tendency to shrinkage is enhanced by the changes in the cells coming in with the leucocytosis. I would point out also that in Case 128, described and illustrated, the follicles are but scantily filled with lymph cells; indeed, the marked feature is their relative scarcity and the great increase in the mass of stroma, yet these masses of stroma tend to be encapsulated.

Of the clinical features of trachoma, no one feature—either papillæ, follicles, pannus, or chronic inflammation—is diagnostic. The papillary exaggeration may be seen in any sufficiently acute inflammation, the follicles in very many quite normal folk, the pannus of the upper part of the cornea in distichiasis, the chronicity in the angular conjunctivitis of the Morax-Axenfeld bacillus. But these four features together are certainly diagnostic; indeed, even two in combination—a chronic papillary exaggeration—may verge on a certainty.

It is so in the examination of conjunctival sections. Single features—enlarged papillæ, a leucocytosis, many and large follicles, an overgrowth of the stroma—cannot alone be taken as diagnostic of trachoma. But a stroma which gives plain evidence of a low form of chronic and deep-seated inflammation by an exaggeration of its endothelial elements in all parts, and particularly in the

formation of great endothelial cells, tallies so little with the state of the stroma in any other known inflammation that we may safely conclude that such a section came from a case presenting the clinical picture of trachoma.

In examining the tissues of the eyes, either normal or diseased, I have made a point of comparing them with similar tissues in the body generally. The inclination to observe the eye as an isolated entity is not without dangerous tendencies ; the eye and its adnexa are part of the body, most of their tissues being common to other parts. Now, the rete mucosa of the conjunctiva is essentially a lymphoid structure ; there is, then, the possibility of alterations in it being paralleled by changes of a similar nature in other lymphoid structures. For example, there is a follicular hypertrophy of the rete of the conjunctiva similar to the adenoid production of the rete of the pharynx. There is an endothelial stroma in all the lymphoid structures ; the changes in the conjunctival rete may be found in some other lymphoid tissue.

In examining diseased lymphoid tissues, I came upon sections from a case of lymphadenoma recently deceased in Middlesex Hospital, and also upon the figures of sections of such cases by Andrews, issued in the publication of the report of a discussion on this subject in the *Transactions of the Pathological Society of London*, 1902. In the sections which I examined, and also in the drawings, I recognised stroma changes exactly similar in character to those found in these trachoma sections. In this disease of lymphadenoma there is a marked overgrowth of many or all of the lymph glands and lymphatic structures of the body, but the essential feature of the disease is shown in the histological examination of the affected tissues. There is an overgrowth of the stroma ; it may become strong and massive, forming fibrous bands traversing

the gland, and enclosing the lymph cells as in capsules. In less advanced cases the particular exaggeration of the stroma is shown in the formation of endothelial cells, often 'in large numbers and great size, which have been called "lymphadenoma cells." These are for the most part multinucleated and deeply stained, but do not resemble the giant cells of tubercle' (Andrews).

Now, the general pathologist is as greatly perplexed as to the meaning of lymphadenoma as is the eye pathologist over trachoma. The general pathologist believes lymphadenoma is not tubercle, though the invasion of tubercle may be facilitated by it; also that it is not a malignant growth—a 'lymphosarcoma,' as it has been termed by many. What it is he is not certain; all that can be said is that it is a process involving 'overgrowth of lymph tissue, or (one) which gives rise to growth closely resembling in structure that of lymphatic glands' (Michell Clarke). Or again: 'There is a diffuse overgrowth of the glandular framework, with a corresponding apparent or real diminution in the contained lymphocytes. I should incline to class lymphadenoma with the infective granulomata rather than with autonomous new growths, though we are as yet ignorant of its exciting cause' (Andrews).

The parallelism of the difficulties between lymphadenoma and trachoma is singular. In each there have been difficulties arising from variant nomenclature, from variability in clinical diagnosis, in want of agreement as to the determining features of the lesion, as to the determining cause of the lesion, and also as to treatment. And some of the difficulties remain.

There is one other parallelism I will venture to put in evidence: In trachoma there is a reasonable grounded belief in the connection of gonorrhœal infection of the conjunctiva with these chronic structural inflammations.

Similarly, I know of a case of lymphadenoma with this association. A healthy student, whom I had known for years, contracted urethral gonorrhœa ; the diagnosis was certified bacteriologically. He was cured of the discharge without complication in the usual course, and there were no indications of a syphilitic infection. Three months later the glands of one side of the neck became enlarged, then the axillary, next those of the other side, and, despite all treatment for what was considered a tubercular condition (his advisers did not know of the precedent gonorrhœal attack), all the accessible glands of the body became enlarged ; his health suffered, he was sent abroad, and died far away from home in less than two years, without any remission of the glandular symptoms. I had no doubt at the time, and I feel more sure when I think over the case, that his was a condition of lymphadenoma—in other words, a wave of lymphoid overgrowth induced by some process arising out of the initial gonorrhœal infection in a subject susceptible to such changes ; he was, as the ancients would have styled him, of the lymphatic type. How these changes are induced I do not know or venture to speculate. (The data of this case is incomplete, in that no post-mortem examination was made.)

Conclusions.

The conclusions I am driven to, after examining all the evidence at my disposal, are : (1) That, so far as microbic influences can be determined, the trachoma of our time is probably the result of an inoculation of the conjunctiva with the *M. gonorrhœæ* of an attenuated virulence, the effects of the inoculation being so mild that they are not noticed ; consequently, in England we never obtain

definite evidence of the organism, the cases being seen too late. (2) That there is started a chronic inflammation of the stroma of the conjunctiva, on which depends the papillary character of the membrane. (3) That the follicular or non-follicular features of the condition are fortuitous, being proportional to the tendency towards follicular enlargement which would be present in the individual, in his usual habit, were the trachomatous condition non-existent. (4) That the condition is a hypertrophy having a wave-length which, once started, proceeds through its degrees to a natural subsidence; and that it is similar in its nature to the changes which all lymphoid tissues have been shown to be liable to under the induction of a similar influence. (5) That the prolonged irritant effects of the lesion are due: (a) To the fortuitous invasion of other micro-organisms, of which the Koch-Weeks bacillus produces the most obvious reaction. (b) To the peculiar situation of the affected tissue, which is in the upper lid, in a structure in continual motion, backed by a stiff plate of fibrous tissue, and pressed down by an active sphincter muscle upon a nearly rigid globe of almost restless mobility, portions of which are exquisitely sensitive. There is no other part of the body in which all these conditions can be found: is it a wonder the effects are peculiar? (6) That the commonly accepted belief in the influence of bad social conditions—overcrowding, dirt, and debility—as essential factors in the production of the disease is justifiable. (7) That there is some basis for the belief in an ethnic predisposition to the disease—given equal conditions, the occurrence is more frequent in the melanochroi than in the xanthochroi.

CHAPTER XVII

THE TREATMENT OF TRACHOMA

IF it be true, as I have suggested in the preceding conclusions, that trachoma is a hypertrophy with a wavelength which, once started, proceeds through its degrees to a natural subsidence, then trachoma should cure itself. I think there can be no doubt that it does. We not infrequently see patients who do not come for treatment until pannus has so affected the cornea that they cannot see. Although there has been no treatment, we see evidences that shrinkage of the overgrowth is proceeding. One of the most perfect cures I have seen, of what had evidently been a well-marked case of trachoma, was in a Jewish immigrant from a Polish village in Russia. The eyes had been bad about fifteen years ago, when nearly all in her village were similarly affected ; she was positive she had never had any treatment. As regards the lids, the cure was perfect ; they retained their naturally soft, lissom, well-shaped condition ; only the delicate scars of the tarsal conjunctiva, radiating like an aurora from the basal edge of the tarsal plate, told of the earlier trachoma. The results would have been perfect had it not been for the fine central corneal nebulæ ; she came to the hospital for ‘glasses to clear the vision.’ With these features of the disease in view, we have to

consider how we can get this same fine and delicate shrinkage of the overgrown endothelial stroma in a speedy manner, and before damage is done to the cornea.

Operative Treatment.

Trachoma can be 'cured' very promptly and expeditiously, there is no doubt, if the lids and mucosa be handled in a sufficiently vigorous style, but the result of such vigour is appalling. Everyone must have seen cases where gross scarring of the deep tissues of the lids and adhesions of lids and ocular conjunctiva have been produced by such treatment. I have by me drawings of such a case taken from a Hebrew immigrant. There is no trachoma, it is true, but the lids, conjunctiva, and cornea are in such a state that I am not sure she would not be better off with the trachoma.

The contrast between this case and that of the Polish woman, mentioned above, who had received no treatment is a strong plea for mildness in our methods: whether by drugs or by operation, *Festina lente*.

On these grounds, scarification, ligature, or shaving of the granulations are to be condemned. They are old methods, and were discredited years ago. Vetch writes: 'Excision by the knife and by the ligature have both been tried, and have been justly reprobated'; and of scarifications: 'When they were not productive of actual mischief, were not attended with any beneficial results.'

The excision of the mucosa of the upper fornix is held to be useful. A ligature is passed through the mucosa at each end of the fold. The fold is then drawn away from the lid by the threads, and a thin fold of mucosa only is cut away by scissors. The scissors must not cut deeply, else the proper structures of the lid are endangered.

Recently, in examining sections of folds so excised, I found therein some ducts of the lachrymal gland ; many of these must be cut through ; whether or no there be any ill effects from this I do not know.

‘Brossage,’ or brushing the mucosa with a hard, short-haired tooth-brush soaked in 1 : 1,000 sublimate solution, is sometimes practised ; it is a barbarous proceeding. I have described and commented on it earlier.

Expression, preferably by means of the simple and cleanly forceps of Grady, is considerably practised nowadays. In cases where there is much follicular enlargement it is of great advantage in unloading the burdened conjunctiva ; but, for the reasons I have explained, it should be gently performed : vigorous squeezing of the everted lids bruises the tarsus considerably and produces a deep inflammation, infiltration, and scarring, with subsequent deformity just in the place where we wish to avoid it.

I have recently practised scraping the diseased tissue lightly with a sharp spoon in cases of the tougher papillary variety with satisfactory results ; the pannus in particular seemed to clear after this treatment of the tarsal conjunctiva. At first I scraped away tissue for cultural purposes alone, but finding patients approved of the effects after the initial painfulness of the operation, I used it with a curative intent. The scraped surface bleeds freely, but the reaction is not severe ; no anæsthetic, save cocaine, is required, and there is no need of ice compresses afterwards. In some cases I have not hesitated to scrape a second time if the condition indicated it. It would appear that this is only a modern application of the ancient method of the Greeks, who used harsh leaves as a raspatory.

Medicants.

During the discharging stage, whether initial or from a relapse, there is no better application than solutions of silver nitrate of 1 or 2 per cent. In the prolonged papillary stage following the cessation of the discharge the use of blue-stone either as a simple crystal or crayon (or the new caustic and painless crayon of Ginestous and Llaguet, containing, besides the blue-stone, orthoform and holocaine) is of the greatest value. The application should be very light, at first on alternate days, later bi-weekly. It is well occasionally to vary the blue-stone by the use of zinc chloride (1 grain or $\frac{1}{2}$ grain to the ounce); it whitens the eye, and allows one to form a better judgment of the state of the mucosa than when the blue-stone is continually in use; besides, the effect of the blue-stone seems to be better after such an interval. These measures are simple and easy of application, a by no means small consideration in these cases, which may run on for months or even into the second year. They have no competitor for excellence of results in delicacy of scarring produced and relative speediness. In all such cases where the patient is not removed to some special place for the treatment of the disease, as is now done in the case of poor children in London, the patient must be warned of the long duration and tediousness of the complaint, and a whole year of treatment insisted upon.

The pannus is best left alone until the lids are clean. In the majority of cases it will then clear up spontaneously. If it persist, something must be attempted for its relief. The influence of inflammations, general and local, on corneal opacities has long been known. Vetch tells of a case where a dense leucoma vanished, and the man

saw again just as the fever of pulmonary consumption killed him. On this principle the inoculation of acute purulent infections into the eye was at one time in vogue. It is never practised now ; the danger is too great, not only to the patient, but to those about him. The infusion of jequirity (*Abrus precatorius*) as a local excitant of a most vigorous kind had been known for years in the Brazils before De Wecker introduced it into Europe. Opinion of its utility differs. Cases of success have been reported, but it has not been my good fortune to see any of them. Other cases have been confessedly failures, and some of these I have seen ; they were most discouraging. The treatment is not without risk to the eye, and the constitutional reaction has some inconveniences ; it is only justifiable when all other methods, such as peritomy, or the use of the cautery on the vessels running to the pannus, have failed. In the more common, less dense varieties the prolonged use of stimulating ointment—strong yellow ointment, 4 or 6 per cent.—and massage of the cornea through the lid, produce a gradual benefit.

The relief of the after-effects of the disease arising from deformity of the lids is a matter for operative interference ; it need not be discussed here, save to repeat the notice of the ill effects of removal of tissue, particularly the cilia-bearing margin, from these shortened lids, for the thin, hard-edge cicatrix of the lid following these excisions produces a raspatory little less effective than a row of stiff incurved lashes. The shifting of the soft tissues with the lashes is now a well-established and satisfactory measure. Parts which are an inconvenience to the eye in an ill position may, when shifted, present no inconveniences, but actually remain serviceable.

Electrical Treatment.

Since the times when Galvani and Volta discussed the phenomena of electricity, and took sides as to whether certain phenomena were the indications of animal electricity or the effect of electricity on animal tissues, there have been repeated attempts to derive curative measures by varied applications of electrical effects, as distinct from the mechanical and thermal properties of the current.

The perusal of old medical literature shows that these attempts were widespread but ephemeral. Many quaint narratives of cases cured after the application of some electrical current are found.

I recently came across an instance in 'Remarks on the Ophthalmy, Psorophthalmy, and Purulent Eye,' by James Ware, Surgeon, London, 1780 : 'A Case of Gutta Serena cured by Electricity.' The symptoms he describes are typical of acute glaucoma. He had tried cupping and blistering the temples and mastoids without effect. So he 'electrified the left eye for a quarter of an hour, first by carrying a stream of electric fire through the eye, and afterwards by drawing sparks from all the parts which surrounded it.' So one eye and then the other eye recovered 'in the happiest manner.' He refers to cases published earlier by Hey.

Electrolysis has been tried for the treatment of trachoma with no effect.* The *galvanic cautery*, as a means of minute cauterization rather than with any idea to mysterious after-effects, has been used. I have tried it without being impressed by any particular

* I have since had a note from Mr. Lindsay Johnson, the author of this treatment. He writes : 'I have performed the operation about 110 times, in most instances with brilliant success. I shall be pleased to let you see some of the results.'

merit. The reaction is often intense. In one case there followed within the week a central ulcer of the cornea, whilst the pre-existing pannus was increased.

Recently a considerable degree of attention has been again directed to the use of electricity or the products of electrical currents. Reports have been published giving results of a most encouraging character ; some reports have even been startling.

Mayou showed before the Ophthalmological Society cases which had been treated with X-rays, and which at the time of exhibition showed no signs of trachoma. During the discussion on the paper Sydney Stephenson said he had obtained similarly good results. But 'in his opinion the best treatment was perhaps by the high-frequency current . . . applied directly to the palpebral conjunctiva by a glass and sealing-wax electrode. He had seen trachoma cured in five sittings, lasting ten minutes each time, and extending over a fortnight.'

At the Middlesex Hospital there is an excellent equipment of all kinds of apparatus for electrical treatment. There is a surgeon in charge—Mr. C. R. C. Lyster—and a staff of nurses, who carry out the treatment under his direction.

We have had cases under treatment by means of the X-rays, high-frequency current, and also with radium emanations.

X-Rays.

Two 'products' can be obtained by the passage of an electric current through a Crookes tube, according to the quality of the tube used and the amount of the current passing through it. These products are (1) the X-rays proper ; (2) a current which is in the nature of an 'overflow' or 'escape' current. The first of

these produces the well-known X-ray photographic phenomenon ; the second has an action more or less severely escharotic on living tissues.

This twofold action may be explained in the following manner : The atmosphere in a Crookes tube is reduced in pressure to a greater or lesser degree ; a tube with a low vacuum, wherein the air is but poorly exhausted, is commonly called a 'soft' tube ; a high-vacuum tube, wherein the air is almost completely exhausted, is commonly called a 'hard' tube. Now, the plates of the kathode and antikathode fixed within the tube are separated from each other by a considerable distance, and the current passing into the tube has to bridge this interval against the resistance of the vacuum. A soft tube containing some air has less resistance than a hard tube which is nearly a true vacuum ; it follows that a soft tube requires less current to work it. Now, it is found that when the current is passed into such a tube the rays increase with the strengthening of the current up to a certain point, which varies with the particular tube and with the condition of that tube at each moment, for the vacuum changes with the temperature.

When this maximum point is reached, however much the supply of current be increased, the rays do not increase. The platinum antikathode plate may become white-hot, it may even be fused, but no increase in the rays is obtained. There is, however, produced some current the nature of which is not known, but which I have referred to as an 'overflow' or 'escape' current ; this it is which produces the so-called X-ray burn, a dermatitis of a peculiarly severe and dangerous character. In proportion to the hardness of the tube used, or the lowness of the current passed into the tube, these irritating effects may be eliminated. The effects of these irritating

emanations are not equally marked on all subjects ; there is a personal equation of unknown quantity, which is only manifest when the untoward results appear.

When I took the trachoma cases to Mr. Lyster for treatment, he asked which of these actions we wished to obtain, for he thought the rays proper might well be investigated, whilst the irritant emanations would be decidedly dangerous.

Since we know very well the effects of caustics on trachoma, and of caustics which can be applied exactly to the spot required, and in any desired strength, it did not seem to me particularly desirable to employ a similar agent, which, whilst most powerful in its action, as I have seen in the condition of many operators' hands both at home and abroad, could not be regulated in the intensity, extent, and duration of its action with any certainty, and which would vary with each case submitted to its action. It did, however, seem distinctly desirable that any action that the X-rays proper might exert upon trachoma should be investigated.

Accordingly, in the treatment of the cases mentioned a fairly hard tube was used, with a 5-ampère current, a combination which produces a maximum of X-rays. The eyelids were held in position from 7 to 10 inches from the antikathode for from five to ten minutes at a sitting. At no sitting was a strong reaction allowed ; the sittings varied in their frequency with the conditions of the case. During the whole of such electrical treatment the patients were given only simple boracic lotion and ointment, applications which could not be supposed to exert any influence on the course of the disease, but, as will subsequently appear, were necessary to the prosecution of the treatment as a *placebo*, for they secured the attendance of the patients.

High-frequency Currents.

Into the theory of the high-frequency current it is not necessary to go, but by a simile its nature may be roughly indicated. If a 4-inch fire-hose be fixed to a water-main, a full stream of water rising to no great height is obtained; if a nozzle of $\frac{1}{2}$ -inch aperture be screwed on to the hose, a small stream of immense force results. The ordinary electrical current of low voltage and large ampèrage is transformed into the high-frequency current of immense voltage and small ampèrage. There are two methods by which the current may be applied.

1. A glass electrode is held a short distance from the tissues. During the passage of the current there is a sensation as of being rapidly pricked by extremely sharp needles. The sensation is due to the stimulation of the minute and rapid sparking passing from the glass electrode. But this is not all, for it has been shown that with the play of the current upon moist surfaces nitrous acid is produced, and Foulerton and Kellas have shown that the effect is bactericidal. This mode of use is, however, too painful for application to delicate mucous membranes for more than a moment; it is, therefore, not available for use on the conjunctiva.

2. By the immediate contact of the glass electrode with the mucous surface the current passes directly through the subject to earth. There is absolutely no sensation caused by the passage of the current, though the presence of the current in the body can be demonstrated by touching the patient with the finger, when the sharp prick of a spark will be felt. Any action on the subject by this application must be due to some subtle and unexplained influence exerted by the passage of the current through the tissues, for no effect of a chemical

nature can be demonstrated by the passage of the current through laboratory fluids.

Treatment of Cases.

In all, six cases were subjected to these electrical forms of treatment. At all periods the condition or any change of condition in the patients' eyes was determined after both independent examination and in consultation.

By the *high-frequency current* four cases were treated. Two were cases of recent disease in young women. In each one eye had a fresh papillary growth on the upper lid, with much pannus of the cornea. In one case the other eye was only just showing signs of the development of the disease ; in the other case the unaffected eye first showed symptoms of the disease whilst it was under treatment. The third case was also of recent disease in a young man ; I had already scraped his tarsal conjunctiva with benefit. The fourth was an old trachoma case in an adult man.

Both the girls got worse, and begged for their old treatment of 'painting.' The young man bolted after six sittings, and refused to come back unless I would scrape him again ; he said the electricity made his vision worse (he was a shoemaker) ; the pannus was extending. The old man was experienced in very many varieties of treatment, but he still had some granulations and pannus, though most of his tarsal conjunctiva was badly scarred ; he had six sittings, and bolted also ; he said he preferred blue-stone.

By the *X-rays* four cases were treated. Two were the girls previously mentioned. The rays were commenced after the lapse of a week from the cessation of the high-frequency current. In one case fifty sittings were made over a period of five months, in daily, alternate day, or

bi-weekly sittings. During these five months the changes in the right eye were such as might reasonably be set down to the processes natural to time. The left eye, unaffected when the case was first seen, had steadily developed the disease until it was as bad as the right ; whatever had been our opinion of the utility or otherwise of the rays, we should have been compelled to stop its use and use something else, for the girl could no longer see her way about. The disease subsequently cleared up in the usual manner with the use of blue-stone.

In the other case twenty-five bi-weekly sittings were made in three months. Again no changes could be found in the way of improvement ; the right eye, initially the worse, at one time seemed to improve, but later went back, whilst the vision of the left, which was not affected at the commencement of the treatment, was reduced to $\frac{6}{24}$.

The third case was the man of forty-five, with old trachoma, who had fled from the high-frequency current, and whom I had beguiled to take the new treatment. He had six sittings, and disappeared once more.

The fourth, a young footman with trachoma of seven months' duration, had received no previous treatment except lotion from a chemist. His case was urgent, as his employer was leaving London, and he feared to lose his post unless he got well. I carefully scraped the upper tarsal conjunctiva and folds and irrigated the sacs ; three days later the surfaces were covered with a new smooth epithelium, and the pannus was diminished. The rays were given daily for twenty-six sittings, when he left London. He was certainly much better for the treatment he had obtained at hospital, but to judge by the observations of others on the case, the improvement took place immediately after the scraping which preceded the use of the rays.

My experience leads me to conclude that neither the X-rays proper nor the high-frequency currents have any influence on the disease. It will run its course, or even increase in intensity and extent of affected tissues whilst the treatments are being carried out. We endeavoured to obtain the full X-ray effects just short of producing dermatitis : that this was obtained is, I think, certain, both by the electrical tests made by those in charge of the apparatus, and also by an indication obtained from the girl who had fifty sittings. At the fortieth sitting her eyes were so bad that atropine was used ; two applications of the ointment started an ' atropine irritation,' with much pain, yet the continued application of this ointment when the rays were not in use produced no discomfort.

Further, although one does not care to lay emphasis on the subjective testimony of patients, I think that when patients—one a skilled workman, another a man who had been to most of the hospitals in London—decline such impressive treatment as the use of the rays, or the even more awe-inspiring high-frequency currents, in favour of such simple but painful methods as those of scraping or the use of blue-stone, because the elaborate measures do not help them, whilst the simpler means so far help them that they can go back to work, we cannot refuse to accept their testimony.

Use of Radium.

So far I have only submitted two cases of trachoma to the influences to be derived from this new agent. Mr. Lyster, of the Middlesex Hospital, has a tube containing 10 m.g. of bromide of radium exhibiting 20,000 'activities.'

CASE 1.—E. G., Jewish girl, aged twenty-two. Fine papillary form of trachoma ; history of eye trouble six

months. The tube of radium was applied to and held in contact with the diseased conjunctiva for the space of five minutes on 139 separate occasions extending from April 26 to October 10, 1904—that is, almost every day during this time. The girl had a weekly supply of 1 : 5,000 perchloride of lotion given her, with instructions to inject it between the eyelids with a dropper. During all this period no change for the better could be detected in the trachomatous conjunctiva.

CASE 2.—A. S., Jew, aged twenty-five. Mixed type of trachoma. The follicles were expressed on two occasions, and simple boracic acid lotion given during the use of the radium. Treatment was begun February 19, and continued on every third day (June excepted) until August 18, when the man left London. In all, thirty-seven sittings of five minutes each were given. No change for the better could be detected ; rather the case had got worse.

CHAPTER XVIII

PHLYCTENULAR CONJUNCTIVITIS

IT has been the custom with some, on account of the clinical convenience, and perhaps in a few instances from a belief of a specific difference, to distinguish between phlyctenular conjunctivitis and phlyctenular keratitis. There is no good ground for such a division ; as has been shown, the upper layers of the cornea are but altered conjunctiva, and in the vast number of cases the two conditions are coincident, have a common origin, and many cases of conjunctival origin will pass into a corneal form.

There is perhaps no disease which is responsible for more damaged eyesight than this. Purulent ophthalmia in the new-born or in the adult and the suppurative processes of severe exanthemata are responsible for the total destruction of eyes ; but this disease, under present-day conditions at home, accounts for by far the greater number of damaged eyes. Even should the injury of the cornea be relatively small, the reduction in visual acuity is considerable, and presents a serious handicap to the patient in the struggle for a livelihood.

Mackenzie, writing with the remembrance of the terrible epidemics of Egyptian ophthalmia fresh in his mind, says of this disease : ‘ Neglected or mistreated, it becomes the

frequent source of permanent impaired vision, or even of entire loss of sight.' If he could, in times when purulent ophthalmia was rife, use such emphatic language, how much more can we nowadays! The ravages of purulent conditions are restricted, but the slower, less disgusting damages of phlyctenulæ are not stayed. Nothing is more heartrending than, when such cases in after-years are passed into the dark-room of a hospital for the objective determination of an 'error of refraction,' to discover by the flash of a mirror a mottled cornea, and to realize that an otherwise excellent eye is spoiled by an irregularity in the density of the cornea, due to an almost forgotten inflammation of no great severity.

The characters of the disease are very definite, both in the age and condition of the subjects affected and in the symptoms.

It is a disease of the **poor**, and of **young children**.

The Moorfields statistics (Fig. 31) show that the maximum incidence is in the school-age group. The detailed year-age examination of the cases at the Belgrave Hospital (Fig. 32) shows that not a single case of the 400 children so afflicted were in the first year of life. The ages of heaviest incidence were from three to eight years, the fifth year presenting the maximum.

Next, it is a disease of the poor and ill-nourished. In the London County Council schools I found half as many more cases in the poor schools as in the average and good schools combined. It may be said that this is solely due to the dirtier conditions of the poorer children. Against this there is to be kept in mind the enormous weight of evidence of many generations of observers that the disease is of a strumous nature—'the first manifestation of a scrofulous constitution' (Mackenzie)—and by this all seemed to indicate that it was part of a diathesis

which we now recognise as a predisposition to tubercular disease.

In examining my statistics, I find a curious contrast in the incidence of this disease and diseases unquestionably associated with dirt among the alien and native patients at Moorfields. The number of alien patients to native in all cases is as 1 to 3·5.

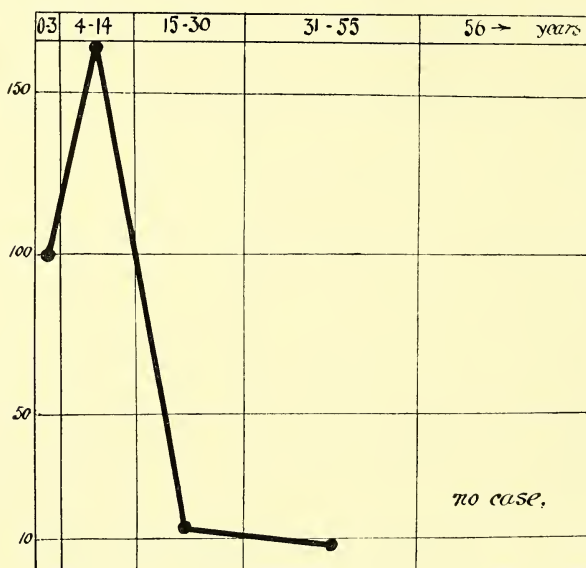


FIG. 31.—THE INCIDENCE OF PHLYCTENULAR CONJUNCTIVITIS (MOORFIELDS CLINIC, 1902).

The bulk of the cases occur in the school-age group.

The ratio of incidence of disease was as follows :

					Alien.	Native.
Conjunctivitis	-	-	-	-	+2	to 3
Trachoma	-	-	-	-	2	„ 1
Blepharitis	-	-	-	-	+5	„ 4
Phlyctenulæ	-	-	-	-	1	„ 3

It is a matter of common belief—and there seems to be a sound basis for it—that Jews (and these are the great

majority of the aliens) are surprisingly immune to tubercle. We find from the above table that, despite the unhappy general conditions of their housing and the like, the poor Jews present a very much smaller proportion of phlyctenular conditions than might be expected from the excessive prevalence of dirt diseases amongst them. Is this

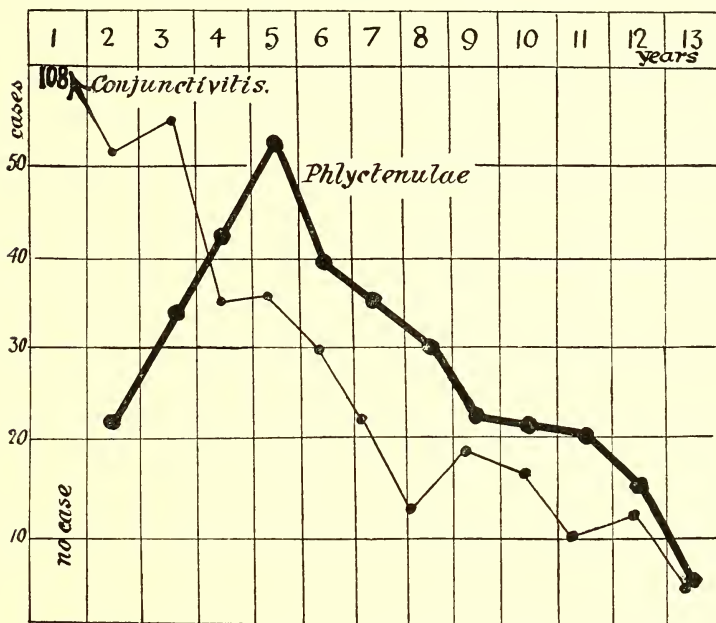


FIG. 32.—THE INCIDENCE OF PHLYCTENULAR CONJUNCTIVITIS (BELGRAVE HOSPITAL FOR CHILDREN, TEN YEARS CASES.)

No case occurred during the first year of life. The great bulk of the cases occur during the decadence of the milk-teeth. Contrast the steady fall in the incidence of conjunctivitis from the first year onwards with the uprise and fall of the curve of phlyctenular incidence.

to be taken as confirmation of the general idea that the condition is a strumous one? It may, perhaps, lend support to the contention, but I think the clue to a lesser liability of the aliens is to be found in something else—**food**.

The staple food of the native poor is tea, with bread-and-butter, and not too much of that. The staple food of the alien is richly impregnated with oils. This, to judge by Zangwill's writings, is due to ceremonial reasons—kosher. Oil comes into their diet to an extent we could not tolerate. Now, the best medicinal cure for phlyctenulæ is cod-liver oil by the mouth, and plenty of it. It seems to me that this is more than a coincidence—it is the clue to the disease. It is a nutritional disease. Our forefathers summed this up in the word 'strumous'; this we now know includes as its principal features tubercle. Defective nutrition is at the basis of the liability to tubercle, but it is not tubercle; so the suggestion of it in the word 'strumous' had better be dropped in connection with phlyctenulæ.

If general malnutrition be the predisposing cause, affections of the regions innervated by the trigeminal nerve are a directly exciting cause. The association of phlyctenulæ with nasal catarrh, herpes of the face, and impetigo, is too marked to be merely accidental. The grounds on which this association can be accepted as something more than coincidence will appear later (Seat of Election, p. 207).

At one time I thought the irritation of pediculi in the head might be an exciting condition, but when I had found that of 328 girls in one school of average cleanliness, 82·3 per cent. had nits in their heads, and only 1 per cent. of the children showed traces of past or present phlyctenular conditions, I concluded that the parasites were undoubtedly associated with the disease, but could hardly be held to accentuate the liability to it!

The symptoms of the affection are characteristic: Slight redness of the conjunctiva locally, great intolerance of light, excessive lachrymation, and the presence of small

whitish elevations, most frequently about the limbus. In the earliest stages there may be only marked photophobia and excess of tears; no injection may be found, local or general, on the most careful examination. Later a leash of enlarged surface vessels will be found on the ocular conjunctiva running towards the limbus and pointing toward the centre of the cornea; at the head of the leash there appears a minute rounded elevation, which may enlarge, break down, and leave an ulcer which has a steady inclination to spread centripetally. The phlyctenulæ may be one or many; either of the eyes may be affected, or both concurrently or consecutively. The nearer they are to the cornea, the slower they are to heal. Those which affect the cornea show a particular liability to a chronic course; those on the ocular conjunctiva commonly heal in one or two weeks at most.

Rate of Healing.—Examination of the periods during which cases observed at the Belgrave Hospital were under treatment brings out some interesting points. There are found to be two groups of cases: (1) A group of the simpler forms, all of which got well by the sixth week. The rates of healing of these cases form an arithmetical progression:

Cured in 1 week	-	-	-	$\frac{1}{2}$	of the total cases.
„ 2 weeks	-	-	-	$\frac{1}{4}$	„ „
„ 3 „	-	-	-	$\frac{1}{8}$	„ „
„ 4 „	-	-	-	$\frac{1}{16}$	„ „
„ 6 „	-	-	-	$\frac{1}{32}$	„ „

(2) The remaining $\frac{1}{32}$ of the total cases form the second group. These all developed a severe, relapsing, and chronic keratitis; some did not recover until as long as thirty-six weeks from the date of their being first seen.

Pathology.—The earlier observers considered phlyc-

tenulæ were minute blisters ; they distinctly described the escape of fluid from them, and its ‘ thin and colourless ’ character (Mackenzie). I have often pricked fresh phlyctenulæ, and I must confess that they collapse as though fluid escaped from them. The observations of Iwanoff on these lesions, particularly those of the cornea, go to show that they are solid elevations of round cells between the deepest layer of epithelial cells and the basement membrane about the ending of a nerve and along the perineural lymph channel ; the changes may be considered as the result of local disorganization due to the disturbance of the trophic action of the nerve. This description of the histology of the phlyctenule does not differ from that of herpes of the integument save at one point : the herpetic eruption definitely contains fluid. Despite the observations of Iwanoff, I cannot convince myself that there is any fundamental difference between the phlyctenule and the herpetiform blister, except such as may arise from the different densities of the epithelium under which the exudations collect. The stratum corneum of the epidermis is relatively impermeable to fluid, and so prevents the escape of the serum which exudes from the vessels at the same time as the leucocytes migrate ; the thinner epithelium of the conjunctiva will allow the fluid to transude and escape as it exudes from the vessels, and the fact that microscopic sections do not show any fluid cavity in the pimple is no proof that it did not exist prior to the use of hardening and embedding reagents. Recently v. Michel has published a work demonstrating that in at least some specimens of phlyctenulæ there is a definite fluid-containing cavity. And in the sections I have of the grosser forms of phlyctenulæ—‘ nodes ’ of the conjunctiva—the effusion had coagulated *in situ*, em-

bedding within its meshes the migrated leucocytes (Fig. 37, p. 214).



FIG. 33.—PHLYCTENULAR CONJUNCTIVITIS IN HERPES FACIALIS.
(See also p. 218.)

Boy, æt. 15. Sickness and diarrhœa five days. Crops of herpes second day and succeeding. Eye affected third day. On the left side the herpes occur on the cutaneous areas of all divisions of the fifth nerve; on the right side in the mandibular only (? one spot in maxillary area above angle of mouth). The phlyctenulæ form an almost complete ring about the limbus; there is a small clear section above. Teeth and nose healthy. Left side of face slightly swollen. The retractors holding open the left eyelids against the blepharospasm are not shown.

Beer distinguished between phlyctenulæ and pustules of the conjunctiva; Mackenzie agreed that the pimples

differed in size and in the severity of the symptoms of photophobia, but could not determine whether the cases differed fundamentally ; a similar difference in cases can be made out now. There is no doubt phlyctenulæ occur in crops, particularly along the limbus, in acute contagious catarrhs, but this is no proof of their pustular nature, for I have notes of a few cases where exactly similar outbreaks followed the use of atropine ointment for refraction purposes ; this liability was marked in children who had suffered earlier attacks, but were quite free from the disease when ordered the ointment.

Some experimental observations were made in a few cases where there seemed a possible difference in the nature of the pimples. No treatment was given save castor oil, to be dropped into the eye four times a day ; the oil rapidly spreads over the whole surface of the conjunctiva, and after the first installation is most comforting in cases of *fresh* undamaged phlyctenulæ ; they rapidly heal up under this warm, smooth covering. If such a pimple had been a true pustule—and by that I mean an infective lesion—it would have got worse under the warm covering of oil, as indeed did happen when the oil was instilled for a couple of days into an eye presenting a fourteen-day-old phlyctenular ulcer, the secretion from which contained numerous cocci. By treating a dozen cases of phlyctenulæ in this fashion, I could not find that there were amongst them any septic lesions simulating phlyctenulæ.

Other evidence has been obtained by three other lines of inquiry :

1. The site where phlyctenulæ most commonly occur—*i.e.*, the seat of election.
2. A bacteriological examination.
3. The influence of season on incidence.

Phlyctenular Conjunctivitis



I. Seat of Election.

On the case-papers of patients at the Belgrave Hospital the site of the pimple or pimples was noted in the majority of instances. A chart was prepared dividing the regions of the ocular conjunctiva and cornea into zones and segments ; on this chart the site of occurrence was marked (Fig. 34). The evidence of this tabulation is most conclusive. The limbus in the temporo-malar quadrant is the seat of election. If all cases had been in a fresh and

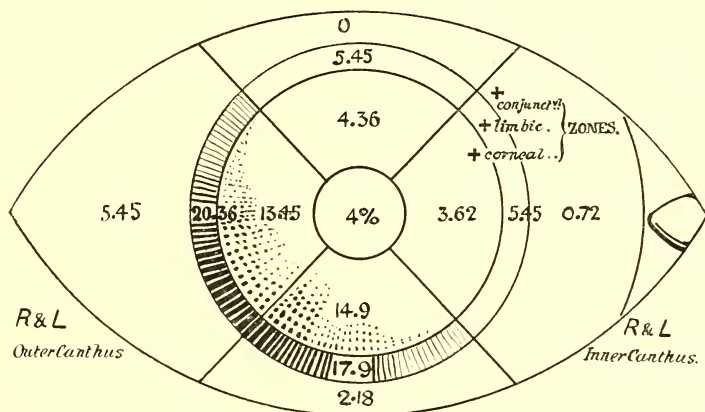


FIG. 34.—THE SEAT OF ELECTION OF PHLYCTENULÆ (BELGRAVE HOSPITAL FOR CHILDREN, TEN YEARS CASES).

Right and left eyes are superposed ; the ocular conjunctiva and cornea divided into conjunctival, limbic, and corneal zones, and into frontal, maxillary, nasal, and temporal zones. The figures on these areas indicate the percentage of cases which were noted to occur thereon. The limbus in the temporo-malar quadrant is the seat of election.

recent state, this result would have been even more striking, for a number of cases which appeared on the cornea had evidently spread from the limbus.

Now, the limbus has by far the most delicate and complete nerve-supply of the whole conjunctiva: the nerve-

endings are more numerous and more closely interwoven here than elsewhere ; this points to nerve conditions as being particularly associated with the affection. Further, the portion of the conjunctiva which is most exposed to injury from dust, etc., is the inner nasal quadrant, as witness the greater frequency of pingueculæ and pterygia in this region. Pustules of the integument occur much more frequently in exposed and irritated positions—as, for example, about the neck from collar friction, on the buttock from friction of saddle or rowing-seat. If true septic pustules of the conjunctiva were frequent, there should be a fairly frequent incidence in the nasal segment, but this is the segment of least incidence, both in cornea, limbus, and conjunctiva.

The question arises, Why should the temporo-malar quadrant be the seat of election ? What peculiar irritation can be associated with the nerves of this region ? The nerve-supply of the conjunctiva is divided in the proportions of about three to two between the first and second divisions of the trigeminal nerve (Fig. 35). The upper half, part of the outer, and the whole of the inner segment of the conjunctiva is developed from the lateral-nasal and fronto-nasal processes, and is innervated by the first division of the nerve ; the lower part and a portion of the outer segment is developed from the maxillary process : it is innervated by the second division. There is a small portion of the outer segment innervated by first and second divisions conjointly. Beyond the extremity of the cleft in the foetus between the maxillary and lateral-nasal process, a point not far distant from the outer canthus, the tissues are, of course, continuous with the side of the head ; in the adult this continuity in tissue origin is curiously shown in the union of the nerves of the two processes by a looped connection from the lachrymal

of the first division and the orbital of the second division. (There is a similar loop, indicating the continuity of lateral-nasal and fronto-nasal processes, to be found at the inner canthus betwixt the supra-trochlear and infra-trochlear branches of the first division.) The respective spheres of innervation are developmental.

The seat of election of phlyctenulæ is in that section, developed from the maxillary process and supplied by the second division which borders on the joint territory at

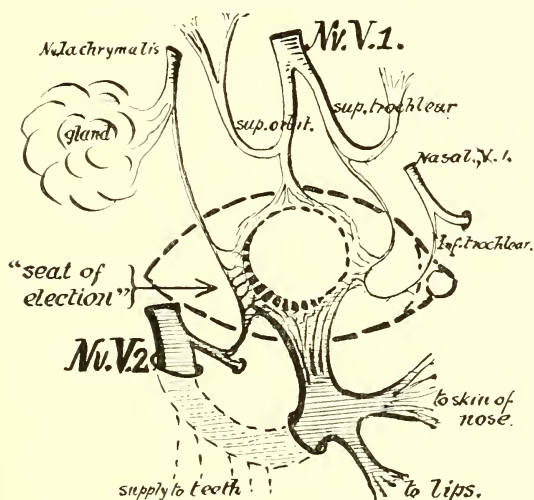


FIG. 35.—THE NERVE SUPPLY OF THE OCULAR CONJUNCTIVA, ILLUSTRATING ITS BEARING ON THE SEAT OF ELECTION OF PHLYCTENULÆ (DIAGRAMMATIC).

the outer quadrant. The second division of the fifth supplies the teeth of the upper jaw ; there is surely enough irritation in the condition of the teeth of poor children about the ages of three and eight, the years of greatest incidence, to disturb the trophic influences of other branches of the same division. Again, the same terminal branch which supplies this part of the conjunctiva also supplies the upper lip and side of the nose, and the fre-

quency with which sordes of the lips, the result of chronic catarrh, are associated with phlyctenulæ is notorious.

There are two other symptoms which may be dealt with here :

(a) The excessive lachrymation.

(b) The photophobia or blepharospasm.

(a) If the seat of election be mainly in the sphere of the second division of the fifth nerve, why is the lachrymal gland so greatly affected, seeing it is innervated from the first division ? The solution of this point is in the looped connection of lachrymal and orbital branches of these divisions : the lachrymal branches, joining in the loop I have described about the outer canthus, come into direct connection with the seat of election ; hence the excessive lachrymation.

(b) It has been suggested that the photophobia or blepharospasm may be a reflex from the irritated conjunctiva, which suggests to the higher centres a reflex from the retina. If this were so, atropine should aggravate the condition ; in the vast majority of cases it does not. The fact that the affected children hide their faces in the dark is no proof of true photophobia ; all animals in severe pain hide in the dark. Recently the question of the nerve-supply of the orbicularis palpebrarum muscle has been discussed. I have shown* that the commonly accepted theory of Mendel that its ultimate origin is from the oculomotor nucleus is incorrect, and brought evidence in favour of the older belief of its proper innervation from the facial nucleus. It was pointed out that in early vertebrates the trigeminal and facial nerves had what was practically a common nuclear origin, being known by zoologists as the facial complex, and that a close connection between the two nuclei is found to persist in man. If this view of

* *Trans. Ophth. Soc. U. K.*, vol. xxiii., p. 356.

the proper innervation of the orbicularis from the facial nucleus be accepted, there is every reason to conclude that the symptoms exhibited are a true blepharospasm, and the result of a direct reflex between the closely associated sensory nerves of the conjunctiva and the motor nerves of the orbicularis, *i.e.*, between the fifth and the seventh nerves.

2. Bacteriology.

An inclination to consider the staphylococcus as a causal agent, either primarily or secondarily, has sprung up owing to the researches of Burckhardt, Gallenger, Bach, and Gifford. Some of these observers have considered the *S. p. flavus desidens*, others the *S. p. aureus*, the most commonly associated organism ; there is no definite agreement. Fuchs, in his text-book, inclines strongly to the belief that a micro-organism may be shown to be the determining factor in the onset of the eruptions.

I have examined twenty-three cases bacteriologically—twenty phlyctenulæ and three ‘nodes.’ Where possible, the following procedure was adopted :

(1) Film preparations and inoculations were made from the conjunctival sac. (2) The sac was washed, cocainized, and films and inoculations made from the ruptured pimple with the platinum needle. In fifteen cases the results were entirely negative, no organisms being found in films or cultures from either sac or pimple. In four cases the results were practically negative, one or two colonies of *S. p. albus* alone appearing, and most frequently in the sac only. Of the other cases, two had a few colonies of *S. p. aureus* in the inoculations from the sac, whilst the inoculations from the pimple were sterile. In one case of probably traumatic origin (a trilobed elevation on the

ocular conjunctiva of the nasal quadrant) many colonies of *S. p. albus* were obtained from the pimple. In another, associated with acute nasal catarrh and numerous marginal phlyctenulæ of minute size, the secretion showed nothing in film preparations, but the hay bacillus was found in cultivations; the organism may very probably have been a contamination.

The result of this investigation is to show that in the early stages of a condition of phlyctenular conjunctivitis the sac is very much more free from organisms than it is perhaps at any other time of life; this, I think, is due to the profuse lachrymation. The eye and its mucosa are washed. The conditions are different as soon as the phlyctenule has broken down, and become an ulcer with an open sore of the conjunctiva; then organisms, so easily supplied by the way in which children in pain rub the eyes, find a ready lodgment, and are proportionately plentiful in the secretion and on the ulcer surface. Three such cases were examined; in each numerous colonies of either *S. p. albus*, *aureus*, or *subflavus* were found.

3. The Influence of Season on Incidence.

In examining the periods of the year during which inflammatory diseases of the eye were most prevalent amongst the children attending the Belgrave Hospital, I was curious to notice that the curve of incidence of phlyctenular cases differed considerably from the curve of catarrhal diseases (Fig. 36). Cases of conjunctivitis are fewest in number in the first quarter of the year, and reach their maximum incidence in the second quarter, during the dry, windy, dusty months of April, May, and June. The incidence of phlyctenular cases is, however,

almost equal in the first and second quarters—95 to 100, a difference not noticeable when it is remembered how frequently severe catarrh occurring in the second quarter will be associated with crops of phlyctenules, and so be classed as phlyctenular conjunctivitis; there is a slight fall in the third quarter, and a greater in the fourth.

This observation of a practically uniform level of incidence during the year for phlyctenular cases, in contrast to the increase of incidence during the second quarter for all ‘septic’ forms of conjunctivitis, tends, I think,

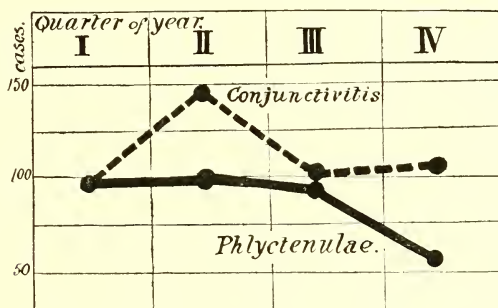


FIG. 36.—THE INFLUENCE OF SEASON ON THE INCIDENCE OF PHLYCTENULAR CASES (BELGRAVE HOSPITAL FOR CHILDREN, TEN YEARS).

During the second quarter of the year, when the air is full of septic particles blown up by the usual high winds, there is no rise in the incidence of phlyctenular cases. This is in marked contrast to the curve found for conjunctivitis (*cf.* Figs. 7 and 8, pp. 28, 29).

to negative the idea maintained by some that the disease is the direct result of some specific microbic action, and to support the view I have maintained that it is a trophic disturbance of the nerves of the conjunctiva—a mild herpes—set up in children of feeble habit by the irritation of the peripheral endings of collateral branches of the same nerve trunk.

Nodes of the Conjunctiva.

Occasionally fairly massive lumps are found on the ocular conjunctiva. They are most commonly situated on the temporal and maxillary quadrants. They are hard, can be moved freely over the sclerotic, are of a pale yellowish-gray colour, and tend to an oval shape. There is usually an intense reaction—*injection* and *lachrymation*.

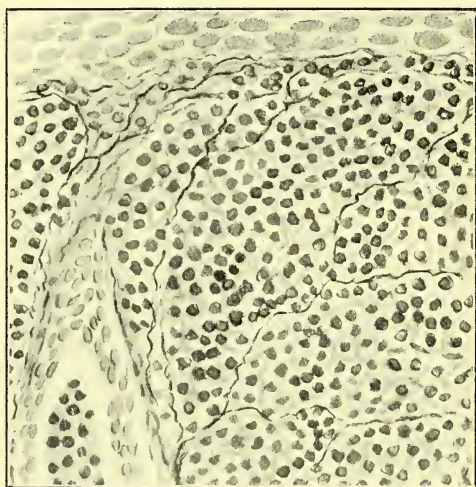


FIG. 37.—SECTION OF A NODE OF THE CONJUNCTIVA.

Girl, *æ*t. 8. The subepithelial tissue is filled with leucocytes embedded in a meshwork of fibrin. The bloodvessel seen at the left-hand lower corner is blocked by a white-celled clot. The wrinkled lines radiating from the vessel wall are elastic tissue.

Three of these cases I have investigated. In none of them was there any history of injury or previous illness. In two cases with marked reactions inoculations from the sacs and from the node were sterile; in the third, where the reaction was diminished at the time of examination, a few colonies of *S. p. aureus* and *xerosis bacillus*

were obtained from the sac, but nothing from the substance of the node. One of these nodes, occurring in a girl aged eight years, measuring 5 by 2 millimetres, was excised; the conjunctival wound healed rapidly and well. Sections of the mass (Fig. 37) showed it to be composed of round cells embedded in a meshwork of fine fibrin; it involved the subepithelial tissue only; the epithelium passed from the healthy conjunctiva on to the sides of the node.

These nodes appear to be exaggerations of the phlyctenular condition, both in their size and in their mode of formation. There is the same exudation of leucocytes in a serous fluid, but the fluid is so rich that it coagulates as it is poured out; this coagulability is an indication of the intensity of the inflammation.

Why this comparatively gross lesion should arise from presumably similar causes as the phlyctenule it is difficult to say. It is possible the difference may be due to an individual peculiarity in the patients affected—such a peculiarity as renders some subjects particularly liable to urticarial nodes on slight irritation, or rheumatic subjects to nodes in febrile states. I regret the possibility of such a peculiarity did not suggest itself to me at the time of seeing the cases; I have therefore made no tests in this connection.

Treatment of Phlyctenular Conditions.

The care of the general bodily health, and the removal of all possible sources of irritation, stomatitis, decayed teeth, sores on the face, lips, and nose, or nasal discharge, with the ever-present pediculi, are the first care. Cod-liver oil, or plenty of fat food, bacon, butter, etc., are invaluable in reducing the liability to further attacks.

In the presence of a fresh outbreak the best means of rapidly clearing up the attack have to be considered. In the stages of acute irritation and photophobia probably the best application is atropine ointment, applied by the surgeon himself between the lids ; the vaseline base forms a warm, soothing covering to the membrane, the atropine quiets the ciliary muscle and iris. A shade should be worn, one of the large pent-roof type, and never the new, closely-fitting celluloid abominations. Later on a slightly stimulating preparation is useful. I have found insufflations of calomel invaluable (always providing no iodine compound is being administered at the same time), but this is no good for home use ; the parents of the patient cannot be relied upon to apply it properly. For this reason ointments are most generally useful. An ointment of finely precipitated and reprecipitated yellow oxide of mercury in lanoline and vaseline of 1 per cent., and later 2 per cent., strength is good. The ointments commonly supplied have large grains of the oxide visible in them ; they are unduly irritating and useless. With a single phlyctenule in an early, unbroken stage the attack may be quickly absorbed by touching the pimple lightly with a fine brush dipped in a 1 per cent. solution of silver nitrate. The benefit appears to arise from the caustic action on the over-sensitive nerve ending.

In those few cases where an ulcer spreads on to the cornea and becomes threateningly deep, special measures have to be adopted. The cornea may, and does in cases, perforate, and the iris becoming involved, a permanent leucoma is produced. Such a case should be in a hospital cot ; with the body clean and well clothed, the eyes under the influence of atropine and evenly bandaged, the ulcer may fill up. Failing a ready response, the ulcer should be cauterized with a solution—a sublimate,

carbolic acid, or silver nitrate. I prefer the first and third of these in strengths of 1:500 and 4 per cent. respectively. The solutions are applied to the dried surface with a fine brush; the effect is purely local. The solutions can be prevented from spreading if the tears be stopped from flowing over the cornea by continually absorbing them into a pledget of wool held in the other part of the lower cul-de-sac.

In some cases the condition of keratitis drags on a long and miserable existence. There is a 'pannus'; leashes of coarse vessels pass the limbus to the deep gutter or pond-like ulcers of the cornea. Usually the children are shockingly ill-fed and ill-kept; their parents have dragged them from hospital to hospital, believing the failure of treatment is the fault of the surgeon rather than their own neglect. I had a group of very poor children so afflicted attending the Belgrave at one time. I took them each into hospital in turn, and touched each vessel, just before it passed the limbus to break up into the corneal ulcer, with the actual cautery as lightly as possible, just so as to make a minute white eschar. Atropine was immediately instilled, and the eye bandaged. On the second day the reaction had subsided, and the child left hospital. In every case, except one where a big vessel had been overlooked and was not cauterized, recovery was prompt and complete. At the end of a week, or at most a fortnight, the ulcers had filled up, and clean scars were left. In the one partly unsuccessful case the ulcers supplied by the cauterized vessels were healed; the one fed by the untouched vessel remained open; it speedily healed on cauterizing the vessel passing to it. The procedure is very simple and expeditious. The touch of the cautery should be as delicate as possible, only just sufficient to close up the vessel. It is to the

long-continued excessive blood-supply and transudation of lymph into the depths of the ulcers in children of feeble reparative powers that the sluggishness and indolence are due ; the cautery closes these vessels, and supplies an efficient stimulus. The general surgeon finds a long-standing indurated ulcer of the leg in aged subjects, best cured by elevating the limb, thoroughly cleansing it, and by the application of a firm strapping to the whole region—*i.e.*, by reducing the blood-supply to the ulcer.

Herpes Zoster Ophthalmicus.

Reference must be made to another condition associated with disorder of the fifth nerve. In contrast to the herpetiform eruption of phlyctenulæ of children, this disease is most frequently seen in adults ; rarely cases are met with in youth, and even in infancy. In all but a very few instances the eruption is within the area of the ophthalmic division of the fifth nerve alone, and on one side. Rare cases are known where other divisions and both nerves have been affected simultaneously.

In the case (Fig. 33, p. 205) of a boy there was herpes of the skin supplied by all the divisions of the fifth of the left side ; and of the mandibular, and perhaps also of the maxillary, of the right side. He had a typical phlyctenular eruption of nearly the whole limbus of the left eye ; a small portion of the frontal quadrant alone escaped. His symptoms of sickness and diarrhœa, pain and swelling of the face, and profuse lachrymation, were typical. There is commonly high temperature, but in this instance the boy was seen at too late a stage for useful observation.

The eye is not always affected by an eruption, but there are at least the symptoms of photophobia and

lachrymation, and usually a general conjunctival injection, followed by a local injection of long duration. In a large number of cases there is also some corneal change—small infiltrations, phlyctenulæ, vesicles, or even bullæ appear. In all the cases I have seen, save one, the eruptions were indistinguishable from phlyctenulæ; in the exception there were small blebs.

In a recent paper on the subject by Head and Campbell the condition has been shown to be due to some acute specific disease, or occasionally poisoning with arsenic or carbonic oxide, which produces an inflammation of the Gasserian ganglion. The intense irritation produced in the nerve cells, from which the axis-cylinder processes of the nerves arise, accounts for the intensity of the reaction on the nutrition of the skin. Herein lies the difference of this disease to phlyctenular conditions common in children. The latter arises by reason of the irritation of nerve endings of collateral branches of similar trunks; the eruption is therefore comparatively mild, and on the ocular mucosa only. The irritation of the central end of the nerve produces the grosser forms of vesication and bullæ of skin and ocular mucosa of herpes zoster.

In a case occurring in a lady, aged fifty-five years, there was a point of exceptional interest pointing to the severity of the trophic changes induced by this acute specific disease. I had seen the patient three months previously: she was quite healthy; the eyes were perfect. Whilst travelling abroad she had a severe attack of influenza, followed by herpes of the first division of the fifth. On my second examination there were scars of the herpes on the forehead, and nebulæ of the cornea, but most noteworthy was the change in the crystalline lens, wherein were seen numerous ‘refraction striæ,’ an early

stage of cataract due to rapid shrinkage ; the vision was reduced from $\frac{6}{8}$ to $\frac{6}{18}$, and could not be improved. I think this rapid change must be explained by the supposition that the attack produced, in addition to the disturbance of skin and cornea, a disturbance in the nutrition of the lens epithelium.

Usually the damage is done when these cases are seen. We can only make the eye comfortable, and prevent the lodgment and growth of micro-organisms on the raw surfaces, by the use of the blandest of antiseptic and analgesic ointments. Atropine is required if there be ciliary injection. The hyperæmia of the conjunctiva will clear up of itself. Quinine is usually employed internally as a tonic.

Pemphigus of the Conjunctiva.

A rare condition. It is a happy circumstance that it is rare, considering the destructive influence it has on the conjunctiva and ultimately on the vision. It is most commonly associated with general pemphigus of the body. Very rarely the conjunctiva alone has been affected.

Four cases have come under my notice—two in women and two in men. In three cases the affection was associated with severe constitutional symptoms ; one man died.

In the fatal case the man had had syphilis badly. No such taint could be traced in the other cases. Further, the man in his daily work came into contact with much slaughter-house refuse, so that it was not clear whether the condition was due to the syphilis, or some malignant œdema of the kind noted in connection with such callings by Mauvezin, Debrou, and others. The women had

never been near such refuse, and it must be added no one else working in the same places as this man had been known to be affected.

The symptoms cannot be better indicated than by a brief summary of the cases in the women.

1. *Subacute Type*.—There were noted nausea, slight pyrexia, crops of bullæ on the body at successive periods, blebs of a similar kind on the conjunctiva not affecting the cornea. I examined the contents of several of the bullæ on the arms when they were fresh and undamaged; no organisms could be demonstrated. The bullæ on the skin healed easily, leaving only a small degree of pigmentation; the conjunctival damage was much more difficult of repair. There was no serious disorganization of the deeper tissues, but cicatrization was slow, and had to be most carefully watched to prevent the adhesion of lids and globe; it could not be avoided altogether.

2. *Acute and Severe*.—(The case was under the care of Mr. Treacher Collins, and shown before the Ophthalmological Society, December 10, 1903, by Mr. W. Anderson. It had some atypical features.) There was an onset with sickness, vomiting, temperature of 102° to 103° F.; a rose rash on the body, said to have been followed by bullæ, which ran together; the skin of the palms and the nails were shed; the mucous membranes of the mouth, nose, and eyes were affected. The local doctor, seeing it shortly after the severity of the initial symptoms had passed, said it looked like an extremely severe measles rash. At the time of exhibition the skin showed the traces of the lesions in a characteristic pigmentation of patches.

The injury to the conjunctiva was severe. The ocular and palpebral conjunctiva was united by numerous bands,

and in places the surfaces were fused ; raw patches still remained, which exuded a muco-purulent discharge ; huge retention cysts of the lachrymal and Krause's accessory glands bulged the upper lids ; and many smaller cysts, probably of mucous secretion from secluded mucous membrane, existed in the lower fold. Mr. Treacher Collins had incised one of the larger upper cysts ; it collapsed immediately. A part of the sac was removed, but no structure other than orbital tissue could be made out.

Such cases as these show the disadvantages attending 'adaptation.' The conjunctiva is marvellously adapted to the service of the visual organ, but when its congener the skin suffers in some general disturbance the conjunctiva may suffer also ; and by reason of its delicacy and its closely-applied folds it suffers disastrous sequelæ to which the skin is not liable.

The final results of such cases are too often the complete loss of sight. As the scarring of the lids and the conjunctival bands shrink, the lids tend to be united to the globe, the lashes are turned in, and the irritation following therefrom causes the cornea to become opaque ; or else by some kind of continuance of the original nerve disturbance the whole of the mucosa of the eye shrinks, and a condition of xerosis results. Several cases of this nature have been recorded.

As regards treatment, practically the only precaution we can take—any ascertained constitutional disorder being attended to—is to carefully control the healing of the damaged conjunctiva so as to reduce the tendency to adhesion of ocular and palpebral conjunctiva to a minimum, just as we do after the lesser injury of a severe lime burn. To secure this, the conjunctiva should be anointed frequently with castor oil, and a glass rod passed

into and along each fornix every three or four hours, day and night. Even with these precautions success will not be complete ; the shrinkage of the scar tissue beneath the fornices seems to drag upon the limbus on the one hand and the lid margins on the other, so as to gradually unite the one to the other.

CHAPTER XIX

SPRING CATARRH

ARLT (1848) first described the condition as 'conjunctivitis lymphatica'; later Desmarres referred to it as 'hypertrophie perikeratique'; von Graefe as 'gelatinous thickening of the limbus'; and Hirschberg as 'phlyctæna pallida.' Saemisch noted the peculiar recurrence of the symptoms in springtime, which gives the common name to the affection.

The condition is rare in this country, though from all accounts it would appear to be fairly common in the East. I have notes of eight cases, seen over the space of three years; they were not all new cases: two had been under observation for years. One of the eight was that of a young girl I discovered during my examination of school-children.

The clinical picture the cases present is fairly distinctive. There is a history of slight inflammation of the conjunctiva of each eye, coming on in the spring of the year. The trouble continues through the hot months; it disappears with the onset of cold weather, only to reappear next spring; so it may go on for years. Examination of the eyes shows that the folds or papillæ of the upper tarsal region are overgrown, and packed tightly together so as to appear as plaques in an irregular mosaic. The conjunctiva

only occasionally shows signs of any degree of inflammation; usually it is paler and less translucent than the normal. The region of the lower lid, since it does not possess folds or papillæ as does the upper lid, shows the changes in a simpler form; the conjunctiva has a milky appearance, suggesting a slight general thickening of its tissues. In a few cases the ocular conjunctiva is the subject of changes, in the appearance of small nodular thickenings about the limbus; these limbic nodules may be the sole evidence of the disease, or be present with the palpebral affection.

It does not appear that in England the affection is more common at any one period of life or in any particular social position. The cases of which I have notes occurred, one in a young girl of poor but healthy parents (her brothers and sisters were healthy); two in small boys of good parentage; one in a Jewish youth of eighteen; another in a woman of forty; another in a man of forty-five; and I know of other cases in folk in good social positions in life.

Occasionally the condition has been mistaken for trachoma, with the consequence that long-continued and vigorous applications of stimulating drugs have been made, making matters appreciably worse. Rarely it has been taken for a malignant growth. In one such case occurring in an English lad living in Japan the upper conjunctiva was completely excised, and replaced by a flap of skin from the temporal region; the unfortunate youth was then in a far worse condition than with the spring catarrh, for when he was brought to England fine hair had grown from the transplanted skin, and the irritation had caused dense pannus. The skin was removed by Mr. Wm. Lang, with excellent result.

The affection is most intractable to treatment. There

is hardly a drug, of antiseptic, antiperiodic, or alterative action, which has not been tried and vaunted as a specific. Quinine and salicylates have been much commended, particularly as local applications ; but what has succeeded in the hands of one and at one time has utterly failed at another time or in the hands of another. The difficulty of arriving at any safe judgment of the utility of any line of treatment is exaggerated by the surprising facility with which the symptoms disappear at one time, only to reappear as suddenly at another.

Recently the use of adrenalin has been strongly commended by Angelucci, and the recommendation is supported by the experience of others. This would be quite in keeping with the nature of the malady as I read its pathology, which I shall state presently. The use of the extract is, however, not without danger, especially in middle-aged folk ; for the instillations have been followed by inconvenient symptoms of glaucoma, as noted by myself, MacCallan, and Jessop (*Trans. Ophth. Soc.*, vol. xxxiii.).

Etiology and Pathology.—There is the greatest variability of opinion. Some hold it to be microbic ; organisms (blastomycetes) have been described by Taylor and by Bellinzona. Danvers, in a recent monograph, rejects the idea ; he could find no evidence of organisms either by histological or cultural methods. Similarly, he rejects Chibert's view of an association with trachoma of a mitigated form ; he is, however, inclined to accept the view of a naso-pharyngeal origin held by several, whose views he quotes.

The morbid histology has been examined by many : Veitsch, Ullthoff, Horner, Knuss, Emmert, Burckhardt, Danvers, Schlub, and Holmes Spicer, have made additions to the literature. They agree in noting the exaggeration

Spring Catarrh



of the fibrous elements of the subepithelial tissue, particularly in a small spindle-cell formation; perhaps also there is some round-celled infiltration, though the appearance may be due to the spindle cells seen in cross-section. There are found a few larger endothelial cells and a slight thickening of the epithelium.

Recently Herbert has published the results of the examination of cases in India. He noted the presence of small vesicles in the growths about the limbus, containing numbers of eosinophile cells; at the same time he examined the blood of the patients, and found an excess of the same leucocytes. The patients, however, were the hosts of nematode worms, and it was not clear whether the eosinophile excess was due to the general disturbance from the presence of the gross intestinal parasites, or to some association with the conjunctival condition. Vesicles, I would remark, are of by no means uncommon occurrence about the limbus, especially when a pterygium is present, and these I take to be obstructed and dilated lymph channels. I have examined the contents of some of these vesicles, and find they vary according to the general condition of the conjunctiva; if it be inflamed, eosinophile cells are found within the vesicles; if it be quiet and healthy, they are practically absent.

Now, there are certain points about the histology of these cases and the clinical history which, if considered in relation to each other and certain other known facts, tend to throw light upon the nature of the affection, and lead to at least a reasonable hypothesis.

There is a definite hypertrophy of the cutis vera portion of the conjunctiva; it becomes a close felt of soft fibrous tissue. The overlying epithelium has a slower metabolism, on account of the lessened vascularity of the felted cutis vera immediately beneath its basement membrane, and it



FIG. 38.—SPRING CATARRH. SECTION FROM UPPER PALPEBRAL-CONJUNCTIVA THROUGH THE SUMMIT OF A PAPILLA, DRAWN ON SAME SCALE AS FIG. 39.

There is marked thickening of the epithelium; its surface cells are almost cuticularized; the epithelium penetrates deeply at the sides of the papilla. There is a great increase of closely-felted fibrous tissue in the subepithelial layer, in which are only a very few lymph spaces and blood capillaries.

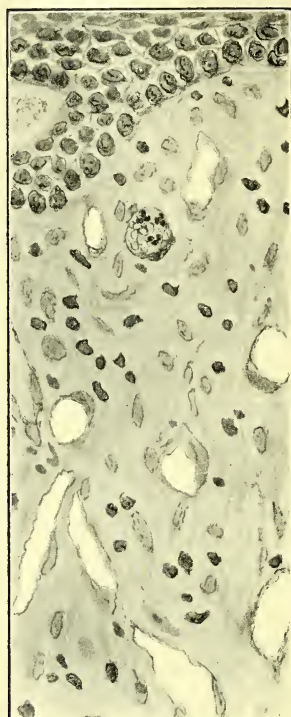


FIG. 39.—SPRING CATARRH. SECTION FROM A LIMBIC NODULE, DRAWN ON SAME SCALE AS FIG. 38.

There is little thickening of the epithelium, but a marked increase of soft fibrous subepithelial tissue, in which are many lymph spaces and blood capillaries. At the top left-hand corner is seen in section a crypt filled with debris.

therefore becomes thicker and denser. Both these causes—the lesser blood-supply of the cutis and the thickened epithelium—account for the characteristic ‘milky’ ap-

pearance of the membrane. The apices of the overgrown papillary ridges of the upper tarsal membrane are flattened by the pressure of the globe ; by reason of this and the mutual lateral pressure of papilla on papilla, the papillæ become compacted at the surface so as to form a mosaic. The secretion of the mucosa in the recesses of the folds or papillæ—the so-called glands of Henle—is kept back by the compaction of the apices of the papillæ, with the result, that any micro-organism gaining access to the conjunctiva finds a well-prepared resting-place wherein to thrive, and causes a more or less violent inflammation for the duration of its activity. There is in this retention of débris and secretion an exact analogy to the retention of smegma beneath the foreskin in phimosis. In each condition it requires but the entrance of some organism to produce a balanitis on the one hand or a catarrh of the conjunctiva on the other.

Now, I have shown by the statistical inquiry into the incidence of catarrhal conjunctivitis, as affected by the season of the year, whether we take the one year of Moorfields Hospital or the ten years of the Belgrave Hospital, that all inflammatory conditions exhibit a striking increase in the spring quarter—April, May, June (Figs. 7 and 8, pp. 28, 29). There is a decline in frequency in the autumn, and the incidence is lowest in the winter months. The reason for this I suggested was to be found in the drying of the soil by the hot sun and dry winds of the spring season, and the scattering of dried débris by the gustiness of the winds. Innumerable foreign bodies are blown into the air, each carrying possibly septic organisms ; some of them find resting-places on the conjunctiva of men. In the condition of spring catarrh the state of the conjunctiva, in the increased depth and partial closure by compaction of Henle's crypts and the collection of the secretions

therein, is remarkably favourable to the reception, retention, and development of micro-organisms. Is it to be wondered that the seasonal incidence common to all catarrhal conditions of the conjunctiva should be strikingly accentuated in such cases by a periodic recurrence ?

But this does not explain or account for the peculiar condition of the conjunctiva itself. I was at a loss on this point until I called to mind that the conjunctiva was but modified integument, and that similar hypertrophy of the fibrous basis of the cutis vera was to be found in the skin, in the condition known as *keloid*. Here there is the same overgrowth of pure fibrous tissue. Most commonly keloid develops from an ordinary fibrous scar, but there are cases of spontaneous keloid not preceded by a wound (Paine's 'Pathology,' p. 261). I saw two or three cases of marked keloid in Kaffirs in South Africa, and I was struck by the manner in which the hypertrophy reproduced in extreme form the normal ridges and papillæ of the skin, just as does the hypertrophy of 'spring catarrh' exaggerate the rugæ and papillæ of the tarsal conjunctiva.

A comparison of sections of conjunctiva from a case of spring catarrh with sections of keloid shows a striking similarity in the fibrous overgrowth. Is it not possible that this fibrous overgrowth in spring catarrh may be a similar development, arising in susceptible persons subsequent to injury, from an inflammatory lesion of some ordinary catarrh or blennorrhœa, or mayhap spontaneously in rare cases, even as with keloid? In the case of the young girl (aged ten), the subject of spring catarrh, whom I found in a Council school, I was able, by visiting her parents and former teachers, to get out a very complete history. She had been quite healthy

and normal-eyed until the age of seven years; then occurred an attack of measles, which was followed by an acute attack of conjunctivitis. The mother was most certain that in this initial attack the discharge was 'thick matter,' and quite different from the watery discharge which poured from the eyes with each recurrence of the eye trouble since that date. In each eye the upper tarsal conjunctiva exhibited the typical pale mosaic, and the lower fold the usual milky appearance. Here, then, so far as we may base any deductions on the evidence of history, there was a sequence of cause and effect—an acute purulent inflammation followed by the fibrotic (or keloid) change known as spring catarrh.

It would appear that this hypothesis is reasonable: it is capable of explaining all the facts known. But this alone will not be sufficient to constitute a full explanation, for although the sequence of events indicated is doubtless a true one, and probably the true one, it does not show on what this peculiar tendency to local overgrowth of the cutis vera in integument and conjunctiva depends. The secret of this overgrowth is, I think, to be found in some altered condition of the lymph radicles, the commencement of the lymph paths which carry off the drainage of the part. I have watched a couple of eyes in young ladies, not specially liable to exposure to wind or dust, wherein the formation of pingueculæ, and in one a tendency to pterygium, followed on the distension of the lymph vessels of a portion of the conjunctiva. There was in these cases no doubt that a fibrous hypertrophy followed the damming back of the lymph flow. It is to be remarked that these lymph vessels were always more prominent in the hot windy weather of spring than at other times. I am inclined to think that blocked lymphatics are the explanation for the presence of

vesicles in Indian cases of spring catarrh mentioned by Herbert.

In cases of prolonged œdema of limbs a general hypertrophy of skin and of subcutaneous tissues has been noted. There is striking evidence of this in the immense hypertrophy of the cuticle, the cutis, and the subcutaneous tissues of parts affected by elephantiasis (arabum), a disease which has been demonstrated to be due to the blocking of the larger lymph channels by the grosser parasites. A similar but restricted blocking of the local lymph radicles, due to changes following the lesion of injury or inflammations, may be reasonably assigned to the local hypertrophy of keloid,* to the growth of pterygia in some cases, and to the overgrowth of the cutis vera of the conjunctiva to form the lesion of spring catarrh. It is worth noting that this sequence of events coincides with the history of the recognition of the features of the condition—Arlt, 'lymphatic'; Desmarres and others, 'hypertrophy'; Saemische, 'recurrence in spring.'

One of some sections from an Italian case I have examined is labelled 'Stained to show glycogen.' Unfortunately, the whole specimen has blackened, and no selective staining can now be seen. If glycogen be found in these tissues it is strong support of a lymph stasis. Glycogen is known to be stored in 'resting' tissues—*e.g.*, the liver of a well-fed, lazy animal, or the breast muscles of the domestic fowl.

Treatment.—Granting the truth of this hypothesis in explanation of the conditions of spring catarrh, does it help us in securing its cure? I cannot suggest that it does greatly. But it will remove our disappointment at the repeated failure of 'specifics,' and certainly

* A case of keloid after herpes ophthalmicus is noted by Holmes Spicer, *Trans. Opth. Soc.*, vol. xii.

prevent the applications of irritating drugs, which will only accentuate the mischief by increasing the vascularity, and therefore the lymph secretion, without relieving the blocked lymph drainage.

As I have pointed out, the periodic recurrence of the catarrh is probably due to the sudden access of micro-organisms, in the months when they are particularly numerous in dust and air, to the *débris* lying within the crypts formed by the compacted rugæ of the upper tarsal conjunctiva. It follows that there is at least one rational measure which may be of service in forestalling this sudden access of organisms: supplementing the washing powers of the lachrymal secretion by copious douching with normal saline solution immediately the dry spring winds set in, and manipulation of the upper lid by gentle rolling movements over the everted conjunctiva with a single blade of Knapp's roller forceps, will be calculated to express the *débris* accumulated within the crypts. Certainly this treatment will do no harm, and it cannot be less successful than the very many other treatments advocated, more especially the vigorous squeezing and painting to which cases have been subjected when they have been mistaken for trachoma.

Local Changes of the Conjunctiva.

Pinguecula.—The yellow body so commonly seen on the inner quadrant of the ocular conjunctiva close to the limbus is due to the thickening of the subepithelial tissue, and to a deposit therein of fatty and colloid substance. This region is the most commonly exposed part of the conjunctiva, and suffers accordingly.

Pterygium.—This is a development from the pinguecula, a triangular fold of conjunctiva, most frequently

seen at the inner quadrant, though cases are not rarely met with in which both inner and outer quadrants are affected ; rarely the outer alone may show the change. These formations are much more common in dusty countries than elsewhere. The Boers, both young adults and veterans, illustrated this generalization well ; in not a few subjects double bilateral examples were found.

The apex of the triangle extends for a greater or less distance over the cornea, rendering the covered portion opaque. Should it reach the pupillary area, vision is obscured, but before it reaches this extent it may cause trouble by reducing the mobility of the eye, causing diplopia in certain positions, and more or less serious irritation by the continual dragging of the eye at its unnatural mooring.

The section of the pterygium (Fig. 40) shows that the epithelium of the cornea has been dissected up by the advancing growth of conjunctival tissue. The head has a distinctly papillary form, indicative of an advancing process at the time of removal of the eye.

In life the bulk of the triangle is found to be merely a fold of membrane drawn into a fan shape by the traction of the new fibrous tissue. The margin of the apex has a clear gray border unlike both the transparent cornea or the denser false pterygium ; this appearance is probably due to the obliquity in which the rather thick ridge of conjunctival epithelium capping the triangle is viewed. I have been able to watch the progressive development of the condition in a young lady of thirty years of age. Five years ago small clear globules appeared on the inner quadrant of the ocular conjunctiva ; they swelled up in windy weather ; later the site became thickened and yellow. The vesicles disappeared in the colder

months of the year, but swelled again when it was windy and hot. At this date a pterygium is commencing to advance over the limbus. There was no history of injury of any sort. The case, I think, shows in a more than usually complete fashion the formation of these bodies. There is an initial damage to one or more lymph radicles, either by a single injury of so slight a nature that it is unnoticed, or the slight and often repeated injury produced by the dust in gusty and dusty weather.



FIG. 40.—PTERYGIUM.

Section from a very early growth of a pterygium. The corneal epithelium is dissected up from the substantia propria by a growth of fibrous tissue. The head of the growth presents three papillæ; it contains bloodvessels and a fairly large lymph space.

The fact that the other eye in this lady is normal inclines me to the view of a particular injury in her case.

Should these bodies become troublesome or threaten the pupillary area, they should be removed. I have found descriptions of quite efficient operative measures in very old books. Arlt pointed out the benefit of closing the wound after excision, and thereby reducing a liability to the formation of a false pterygium.

False Pterygium.—A peculiar scarring of the conjunctiva following definite injuries from burns of the limbus, and simulating the form of a pterygium. I have seen several such cases in metal-workers. Similar conditions following severe purulent conjunctivitis have been described. The conjunctiva during a state of chemosis overlaps the cornea, and becomes adherent to it at some point of ulceration. These formations have a clear tunnel under the fold.

Occasionally bands like pterygia are produced by severe burns involving both conjunctiva and cornea. When not inflamed they simulate the form of true pterygia, but attempts to remove them by the usual methods employed for pterygium show that they have a strong and deeply-rooted basis in both cornea and conjunctiva. If attempts are made to strip them off the cornea there is a risk of splitting or separating the corneal layers. I once saw this accident take place; the cornea at the site of the false apex turned white when the fold was pulled up, just as will a piece of clear horn when a knife-point is inserted into its strata.

Colloid Degeneration of the Conjunctiva.—This is a rare disease. I have not yet seen a case, though twice at a first examination of cases the diagnosis was suggested. One proved a 'brawny trachoma'; the other was uncommonly suggestive of a diffuse colloid degeneration, but proved to be a myxo-lymphoma.

The degeneration is described as commencing in the subconjunctival tissue. There is first an increase in the adenoid tissue, then a degeneration succeeds, and the tissue gives an iodine reaction. The degenerate tissue has no connection with the amyloid disease of parenchymatous organs in continued suppuration, for in the eye condition the body generally is healthy.

The material is deposited in concentric layers around some centre—capillaries (Greeff), leucocytes (Herbert). Ultimately the deposits may form such large blocks as to prevent eversion of the lids. The determining cause of the disease is not known ; it has been observed to follow trachoma, but since it occurs primarily, it is not necessarily dependent upon it. Adults only are affected, and in both eyes. The lids are its most frequent seat, but colloid particles have been found in the ocular conjunctiva. Late stages of calcification and even ossification are described.

Removal of those portions which form inconvenient masses is advised.

CHAPTER XX

XEROSIS CONJUNCTIVÆ

A DRYING of the conjunctiva, but finally the shrinkage and atrophy of all the adnexa of the bulb, with loss of vision. The simpler forms have been called epithelial xerosis, and the grosser forms, leading to complete shrinkage, parenchymatous xerosis.

Instead of the normal uniformly moist, shining, transparent and lissom mucosa, parts or all of it appear opaque, dry, and greasy, as if rubbed with suet; the affected parts feel thick and stiff; the tears flow, but do not wet the greasy surfaces. In the end the tears cease altogether, and the cornea becomes completely opaque.

The change is in every case of an atrophic nature. The primary cause may be: (1) Local, or, probably more correctly, local and general; (2) general alone.

It may follow the more severe forms of inflammation or injuries, such as purulent conjunctivitis, trachoma, diphtheria, pemphigus, or burns. Of seven cases of which I have notes, three, of the epithelial type, followed ophthalmia neonatorum, and in two there was also a marked degree of keratomalacia. The infants were small and ill-fed; the conjunctivæ dry and lacking in sensitiveness; the fornices were filled with rolls of dry, curdy material swarming with micro-organisms—the xerosis

bacillus for the most part ; the flow of tears seemed to be stopped. With these infants marasmus was probably a general cause, and the severity of the purulent inflammation and perhaps the prolonged use of silver solutions the local cause. The intrinsic mucous-secreting functions of the cells of the mucosa, and perhaps also the secretory functions of the lachrymal gland, were lost or in abeyance. Both marasmus and a local inflammation seem necessary to produce the conditions in England ; I have seen very many babies with extreme marasmus alone, or with ophthalmia of great severity alone, yet xerosis has not followed.

In these three infants the xerosis and keratomalacia speedily cleared up with improved general nutrition, promoted by the use of cod-liver oil both by the mouth and by inunction, and by local applications of drops of castor oil to the conjunctiva several times in the day.

When the xerosis is consequent on trachoma, pemphigus, burns, and such causes, it is of the parenchymatous type. There is general shrinkage of the conjunctiva ; it is permanent, and a smooth conjunctiva cannot be retrieved by any means. It is possible that the case shown in Fig. 41 arose from either trachoma or pemphigus, although the old man was positive there had been no previous inflammation, except such as arose from getting sand in the left eye some years previously—an injury he speedily recovered from. The thinness of the skin of the face of this man was remarkable ; it was less sensitive than normal, as was also the mucosa of both eyes. In the right eye only one fairly normal piece of mucosa remained, just at the site of the ducts of the lachrymal gland.

Considering the frequency of severe inflammations and injuries and the rarity of xerosis, it is not improbable that

these cases may be due to some general condition such as a loss of nerve sensibility, as well as to a local exciting cause.

Deficiency of shelter to the eyes has been described as the determining cause in some cases. I have seen none such. In the two women referred to as examples of the tolerance of the conjunctiva (Fig. 1, p. 13) the eyes were as helplessly and constantly exposed as any I have ever seen, yet the mucosa of each was quite soft and moist. In the lupus case, if anything, the mucous secretion of



FIG. 41.—XEROSIS, OR 'ESSENTIAL' SHRINKAGE OF THE CONJUNCTIVA.

Irishman, *et.* 70, formerly London docker. Denies previous eye disease, except slight injury many years ago to left eye—which is in a less advanced stage of shrinkage—whilst unloading sand. R.V.=p.l. only. The conjunctiva is cuticularized, and is continuous with the thin atrophied skin of the face. One pink spot of moist mucosa remains at the site of the ducts of the lachrymal gland. The skin of the face is very soft, thin, and wrinkles like fine kid. It is dusky in colour. This atrophy is more marked on the right side of the face than on the left.

the membrane was increased; and in each case the exposure had existed for so many years that a definite period could not be put to it by the patients.

Xerosis from general changes alone are rare in this

country. I have notes of cases which may come under this category: One in a man with early tabes dorsalis, in whom the exposed ocular conjunctiva of each eye had plaques of thick grease-like material crowded with the xerosis bacillus; another in a boy of thirteen, blind from optic atrophy. Similar plaques appeared on the conjunctiva, and have remained for two years.

Recently I came across a boy in an elementary school with exactly similar plaques on the conjunctiva of each eye; no cause could be discovered for their presence. The eyes were of normal shape and position; the lids covered them at each blink. The boy was fairly well nourished and healthy, the vision was good, and there was no difficulty in reading in a poor light; his teacher said he was a little dull, but there were many more stupid boys in the class.

Severe forms of the disease are described as occurring in young children associated with keratomalacia, which is perhaps the primary feature. The condition is said to appear in Russia in children who previously have possessed healthy eyes. Apparently, this form does not occur in England, except, as I have noted, after the ophthalmia of the new-born.

The anatomical changes are primarily in the epithelium. It approximates to the epidermis. It becomes thicker, it loses its power of secreting mucus, it appears to be opaque from the deposition of fatty matter either from the Meibomian glands, or probably from the formation of fatty and keratin material in the cells themselves. The tears no longer wet the surface, so it appears dry. Leber has shown that the plaques may be removed by washing with soap; then the tears wet the cleansed surface in normal fashion.

In the case of epithelial xerosis in infants, the function

of the lachrymal glands was suspended for a time, but was recovered later. In the grosser parenchymatous condition there is a steady diminution in the tears, and also, as Arlt has shown, in the size of the gland itself, with the advance of the xerosis; the atrophy has been ascribed to the obliteration of the efferent ducts of the glands by the shrinkage of the mucosa. In the case of the old man with marked xerosis and shrinkage of the conjunctiva, at the site of these efferent ducts was a patch, about 3 millimetres square, of moist pinkish mucosa, the last patch of healthy mucosa remaining.

The rôle of the xerosis bacillus described by Kuschbert and Neisser has been much discussed. The possibility of the organism being the determining cause is discounted by the fact that it has been found by various observers in nearly 50 per cent. of normal eyes. In my school-children it was obtained in 36 per cent. It is an organism of the diphtheroid group, and is non-pathogenic.

At the meeting of the British Medical Association (Swansea, 1903, reported in the *Journal*, October 24, 1903) there was a discussion on the pathology of general paralysis of the insane. Ford Robertson stated that in the subjects of the disease 'there is evidence of the almost constant presence of a bacillus which in its cultural and morphological characters resembles the Klebs-Loeffler bacillus . . . and that this diphtheroid organism occasionally takes part in a terminal blood invasion of such cases'; he was inclined to consider it a determining cause of the paralysis. Robert Jones 'looked upon the general paralytic as a person of low vital reaction in the later stages, and that he became a prey to these invasions, . . . but he considered them non-essential as regards causation.' Hamilton cited a case of paralysis from shock, in which the gray matter of the cord was crowded with bacilli. Adami said he would 'be cautious in accepting such

bacilli as the essential and, so to speak, primary specific agent in the development of general paralysis.' The general pathologist has therefore the same perplexity as confronts us.

Xerosis of the eye may undoubtedly be associated with severe marasmus, with general disorder, or with degenerations, as of optic atrophy or tabes dorsalis. Does the organism cause the condition, or is its presence favoured by the condition? The great frequency with which the organism is found in normal folk, and the rarity of xerosis even when there are apparently sufficiently effective local or general causes existing, point rather to an association only.

Argyrosis.

This is not a degeneration, but it is conveniently considered in this group.

It is the effect of the prolonged use of silver solutions. Fig. 41 illustrates a most extraordinary case which recently appeared at Moorfields. A Jewish woman who had suffered from trachoma had evidently used a silver solution on her own initiative for many years. The trachoma was cured, but all quantitative vision was lost. The whole of the cornea was a greenish black, and impermeable to the fundus reflex. The conjunctiva, especially those parts which were least closely applied to the globe by pressure, were deeply pigmented. The silver was deposited as a black oxide or albuminate.

The sections from the case are most wonderful; every scrap of elastic tissue is mapped out in fine dots. I do not think I have ever seen a finer demonstration of the fenestrated membrane of Henle in the arterioles than appears in these sections.

The manner in which the silver becomes taken up by the

elastic tissue is thuswise : The silver has a selective action on the intercellular cement substance. It is first deposited in this material, as can be demonstrated by injecting a solution into the bloodvessels of a frog ; if the solution be strong enough, it will not only map out the endothelium, but also the smooth cement substance between the muscle fibres. Now, elastic tissue is really an intercellular cement substance, in that it is the secretion of the con-



FIG. 42.—ARGYROSIS FROM PROLONGED USE OF SILVER SOLUTIONS IN TRACHOMA.

Jewess, æt. 65, Russian immigrant. The eyes are a dull greenish black. The staining is most marked in the cornea and loose conjunctiva ; where the lids are pressed on the globe they are less stained, and where the epithelium is thick, as at the puncta, the staining is masked. V=p.l. only. The cornea, under focal illumination and high magnification, could be seen to be divided into plaques by clearer lines, the tracks of bloodvessels. (For section of conjunctiva from this case see Fig. 43.)

nective-tissue cells ; the deposit in the unorganized cement substance is rapidly removed by the action of leucocytes, for its metabolism is rapid ; but the metabolism of the elastic fibres, on the other hand, is the slowest in the body, except, perhaps, that of the bones, consequently, any substance taken up by this tissue remains unmoved for an extremely long time. In the

case of this Jewish woman I attempted to hasten the metabolism of the subconjunctival tissue, and so promote absorption of the deposit, by repeated subconjunctival injections of tap-water. Each injection was followed by a marked chemosis, and it appeared that there was some slight clearing of the pigment in the one eye that was treated.

Stephenson recently showed cases of copper deposit in



FIG. 43.—ARGYROSIS FROM PROLONGED USE OF SILVER SOLUTION IN TRACHOMA.

Section from conjunctiva of lower lid in case described in Fig. 42. The epithelium is much thickened, the surface layers are partly cuticularized, there are a very few goblet cells in the deeper layers, no silver deposit is to be found. The subepithelial tissue is denser than normal; every strand of elastic tissue, especially the elastic part of the tunica intima of the bloodvessels, is mapped out by fine black dots, the deposit of precipitated silver salt.

the cornea of subjects of trachoma who had been subjected to treatment with blue-stone for long periods (*Trans. Ophth. Soc.*, vol. xxxiii.).

The occurrence of such cases indicates the danger attached to the prolonged use of metallic solution or crystals, particularly to the uncontrolled use of silver solutions.

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